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ABSTRACT

Stewardship is the responsibility of individuals to maintain and improve their natural resources and surroundings. The Forest Stewardship Program (FSP) in North Carolina aims at enhancing the management of all forest resources on private lands. This activity guide is designed to help youth appreciate and understand forests and natural surroundings. It contains easy to follow classroom and outdoor activities that link youth to the forest using the topic areas of soil and water, wildlife, trees, recreation, and natural beauty to develop the concept of stewardship. Activities include: (1) FSP and Me; (2) What is a Forest?; (3) How Convincing are the Facts; (4) What's the Use?; (5) Sharing Space with What?; (6) Point To a Problem: Point To a Solution; (7) Habitat: Healthy or Hurting?; (8) Wetlands Make a Difference; (9) Field Report; (10) The Traveling Water Show; (11) Who's There?; (12) How Many Trees on That Tray; (13) Camp Out!; and (14) I Look Like a Forest Steward. A resource list for additional activities is also included. (JRH)

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BRANCHING OUT

The North Carolina Forest Stewardship Activity Guide

ED 406 206

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Produced in association with the
NC Forest Stewardship State Committee
and

North Carolina
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BRANCHING OUT

The North Carolina Forest Stewardship Activity Guide

(A Middle School Environmental Education Activity/Study Guide for Forest and Natural Resource Issues)

WELCOME

BRANCHING OUT is your guide for helping youth appreciate and understand our forest and natural surroundings. Easy to follow classroom and outdoor activities link youth to the forest. Soil and water, wildlife, trees, recreation and natural beauty are the topic areas used to develop the concept of stewardship.

Stewardship is the responsibility that each of us has to maintain and improve our natural resources and surroundings. (The Forest Stewardship Program is aimed at enhancing the management of all forest resources on private lands, the stewardship message has implications for all of us.) Our hope is that by enlightening our youth to the fundamentals of resource stewardship, present and future generations will benefit.

This guide has undergone regional comment and testing in middle schools across North Carolina and was compiled with respect to the Integrated Science Curriculum and Philosophy for the Science Curriculum developed by the N.C. Department of Public Instruction. The format for BRANCHING OUT is flexible to meet local curriculum and subject matter. It's success will require a commitment to "involve" the student with the natural environment. To achieve this, take advantage of the resource professionals and forest stewards in your area that are putting these concepts to work everyday.

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Lesson 1

FSP AND ME

TIME: 1 Hour

OBJECTIVE: To introduce the concept of stewardship.

MATERIALS: Video and poster
(Forest Stewardship video and poster)
Available from your County Ranger or
Cooperative Extension Agent

BACKGROUND:

Stewardship is the wise use and conservation of natural resources.

The Forest Stewardship Program (FSP) is funded through the United States Forest Service and became federal policy and law as part of the 1990 Farm Bill. The primary goal of Forest Stewardship is developing productive land and healthy natural resources. The approach is simple: recognize and help private landowners by providing information, education, and technical programs.

The FSP is a private/public partnership that offers landowners valuable information from one collective source instead of several separate sources. In the past, landowners who wished to manage their land in more than one way, perhaps both as a tree farm and a recreational area, had to visit or call several agencies to obtain necessary information. This process was time consuming and often provided confusing or conflicting information. The FSP partnership saves time and offers detailed resource information to the landowner. Agencies that contribute to FSP and the information they provide include:

- Farm Service Agency—farm and conservation programs
- Forest Service, US Department of Agriculture—public forest land management
- North Carolina Cooperative Extension Service—education, plant identification and cultivation recommendations
- North Carolina Division of Forest Resources—tree planting and forest management
- North Carolina Division of Soil and Water Conservation—soil and water protection
- North Carolina Wildlife Resources Commission—fish and wildlife management and regulation
- Natural Resources Conservation Service, US Department of Agriculture—soil conservation and water protection
- Private contractors and natural resource managers—planning and management advice and assistance

Branching Out Keys

To simplify your use of this activity guide, each lesson is labled with an icon. Each icon represents a resource area that is targeted in the Forest Stewardship Program.

**For Your Ease,
Follow the Keys!**

Cost sharing assistance, too, is available to landowners who participate in the program; plus, landowners who enhance their forest resources may have their property certified as a Stewardship Forest.

In the end, the entire public benefits from the many environmental contributions made by a well managed and healthy forest.

BEFORE THE ACTIVITY:

View the video entitled FOREST STEWARDSHIP: Wise management for today and tomorrow.

LEAD-IN:

What are some of the land use choices available to a landowner? For example, the land may be developed, let alone, or sold.

We often think that the only way to save our land is to let it alone. Sometimes we think of owning land as an investment only in an economic sense. However, there is more than one way to look at a piece of land.

ACTIVITY:

View the video.

After the video, have a short discussion of the BRANCHING OUT questions. Then ask the students, either individually or in groups of three, to prepare a 3x5 newspaper ad promoting the video. Remind students that their audience is the general public, either small/large town, or urban/rural. These ads may be sent to

Extension Forestry
Box 8003
NCSU
Raleigh, North Carolina 27695

where selected advertisements will be posted on department bulletin boards or published in the *North Carolina Forest Stewardship News*.

BRANCHING OUT:

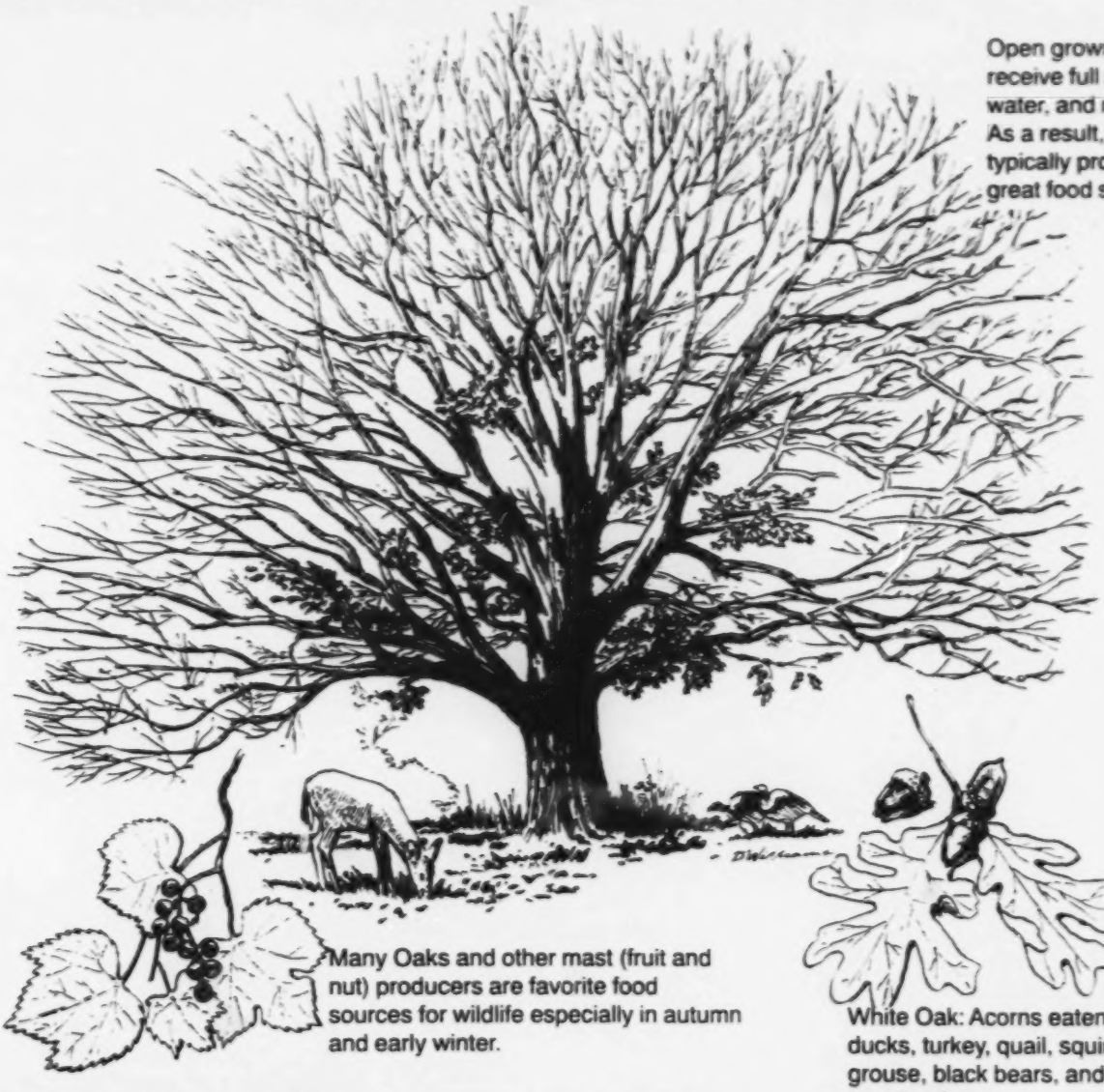
1. What are some things that may be done to become a Forest Steward landowner? (To manage the forest for timber and wildlife, to manage for timber growth and harvest, to plant for wildlife food and cover, or to put up bluebird, duck or bat houses.)
2. Can a Forest Steward still make money from the land? (Yes, better management techniques and increased information on types of plantings for the soil and climate will help the steward increase production and financial returns. Improved production methods also benefit the natural resources.)
3. If you were a landowner, what activities would you want on your land? (Farming, hunting, enjoying the beauty, producing timber, or growing plants and wildflowers.)
4. How do the decisions of other landowners affect you?
5. Individually or in small groups, have students report about a news article describing a program using good stewardship practices.
6. Assign small groups to prepare a means of promoting forest stewardship to private landowners.

NOTE:

Additional videos are listed in the *Project Learning Tree* resource book. The video *Backyard Wildlife* is also available from your local North Carolina Wildlife Resources Commission representative.

Managing Forests For Many Uses

Stewards select trees for multiple benefits: Timber, wildlife, beauty, fall color, and plant diversity.



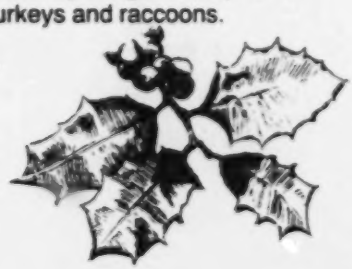
Open grown trees receive full sunlight, water, and nutrients. As a result, they typically produce great food supplies.

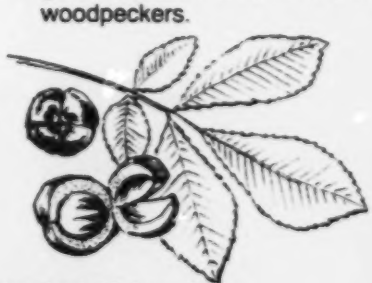
Many Oaks and other mast (fruit and nut) producers are favorite food sources for wildlife especially in autumn and early winter.

White Oak: Acorns eaten by deer, ducks, turkey, quail, squirrels, grouse, black bears, and some woodpeckers.

Grape: Food for deer, black bears, raccoons, songbirds, foxes, grouse, and turkey. Dried fruit provide food in winter.

American Holly: Fruit and seeds eaten by songbirds, squirrels turkeys and raccoons.





Loblolly pine: A favorite for squirrels, songbirds, turkey, quail or mice.

Shagbark Hickory: Nuts eaten by squirrel, turkey, and wood ducks.

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Lesson 2

Trees

WHAT IS A FOREST?

TIME: 1 1/2 Hour

OBJECTIVE: To understand the concept of forest diversity.

MATERIALS: Art supplies such as construction paper, glue, and markers
Hand out

BACKGROUND:

North Carolina is a biologically diverse environment in which great natural beauty is created by the numerous species of plants and animals. This diversity extends into our forests where a variety of trees, plants, and animals interrelate and affect one another.

Our forests differ noticeably in size, composition, and age of the trees found in the area. Generally, North Carolina's forests are in stages of transition from seedlings to mature trees. Tree age goes largely unnoticed by the forest visitor, but to a forester, forest maturity is an important concept.

Forests can be categorized into specific types, such as hardwood or conifer. North Carolina has more species of hardwoods than any other state. These species include oak, hickory, maple, ash, poplar, sweetgum, and blackgum. Our mountains include these hardwood species plus Fraser fir, yellow birch, mountain maple, mountain ash and red spruce which are also found as far away as Canada. Along with trees, wildflowers, shrubs, vines, and wildlife live in mountain forests. Pasture and cropland often border forested land.

Coastal areas may have forests with loblolly, longleaf pine, cypress, and Atlantic white cedar mixed with large shrubs and hardwoods such as sugarberry, hackberry, tupelo and oaks including water, willow, live, and cherry bark; or they may have wetlands teeming with ducks, geese, swans, snakes, turtles, alligators, and the endangered red wolf and Red-cockaded woodpecker.

The Piedmont, too, may have forests with a mix of pine trees and hardwoods, but wildlife is often limited because of the proximity of large population centers. However, hawks have been spotted in most of our cities, and eagles are found only a few minutes from Raleigh. Raccoons and beaver invade urban ponds, and deer and bear occasionally wander into towns.

The acreage of old forests may be shrinking, but there are many newer areas of growth and protected areas such as parks and greenways. While the typical visitor does not consider parks or greenways "forest," these areas are important environmentally and play an important part of North Carolina's forest diversity.

BEFORE THE ACTIVITY:

Have all art supplies available

Have hand out (page 9) prepared for distribution

LEAD-IN:

We're going to explore the idea of forest diversity which includes not only the number of different species within a given area but also the number and extent of forest types in a region.

Before this exploration, let's begin by considering some questions.

Does nature take care of the forest?

As people, what is our responsibility to the forest?

How do we interrelate with the land we use?

How do we interrelate with land where we have no access?

As an individual, what relationship can you have with a forest?

Many people believe that nature takes care of a forest and that people should adopt a "hands-off" position. Do you agree? Also, people living in an urban area with little natural forest often never think about North Carolina's forest. Should they?

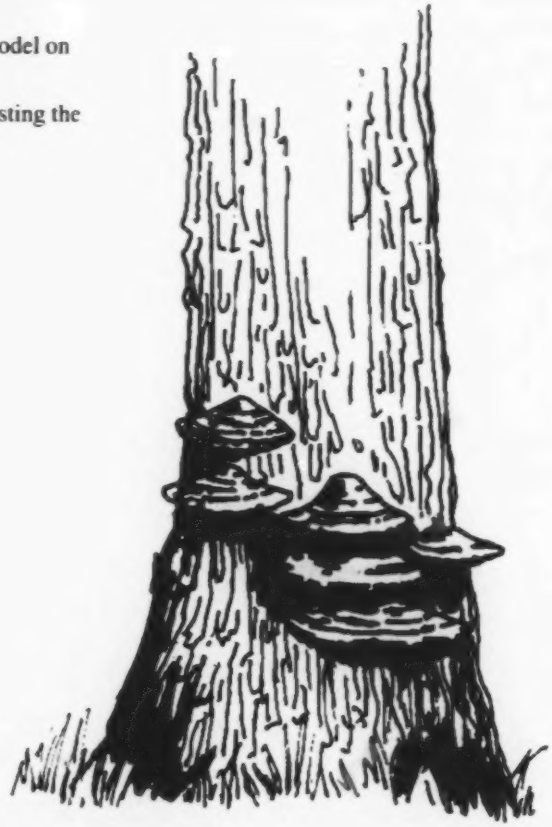
(After building the forests and discussing the composition, these questions could be re-explored. How have responses and perceptions changed, if at all?)

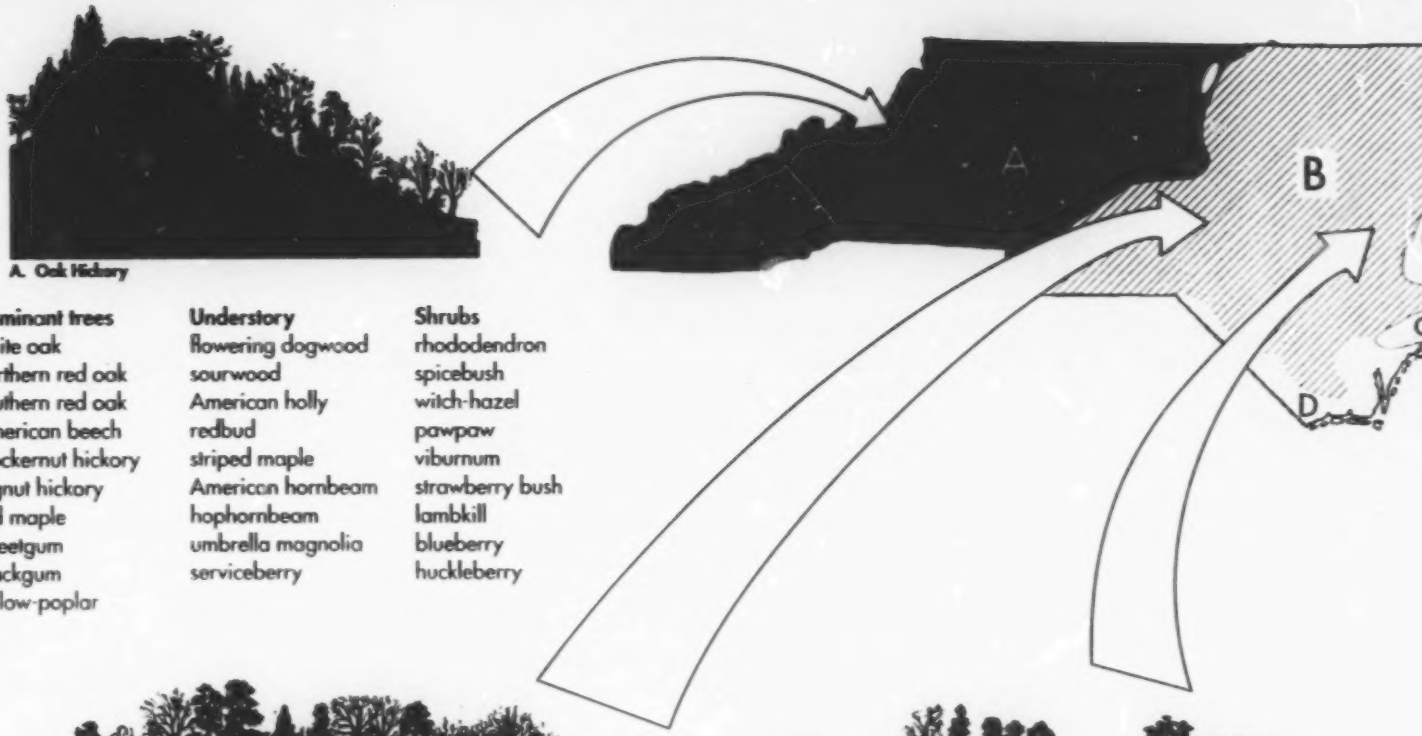
ACTIVITY:

1. Ask individual students to list what is contained within a forest.
2. Divide class into groups of three or four students.
3. Instruct students that they may make a forest ecosystem model on paper or in a three dimensional diorama.
4. Distribute major forest types of North Carolina (Page 9) listing the different forest types and their composition.
5. Ask each group to construct a forest.
6. Have each group list what comprises their forest.
7. Discuss the forest models.

BRANCHING OUT:

1. Why do you think forest diversity is important?
2. How would season, years, and development affect the forest you modeled?
3. How would you make a simple model explaining the input/output of water or sunlight?





A. Oak-Hickory

Dominant trees
white oak
northern red oak
southern red oak
American beech
mockernut hickory
pignut hickory
red maple
sweetgum
blackgum
yellow-poplar

Understory
flowering dogwood
sourwood
American holly
redbud
striped maple
American hornbeam
hophornbeam
umbrella magnolia
serviceberry

Shrubs
rhododendron
spicebush
witch-hazel
pawpaw
viburnum
strawberry bush
lambkill
blueberry
huckleberry

B. Loblolly-Shortleaf Pine

Dominant trees
loblolly pine
shortleaf pine
Virginia pine

Understory
blackjack oak
post oak
sweetgum
mockernut hickory
flowering dogwood
blackgum
white oak
redcedar
black oak
persimmon

Shrubs
wax myrtle
gallberry
viburnum
blueberry
greenbrier
blackberry
honeysuckle
hawthorn
smooth sumac
beautyberry

C. Longleaf Pine

Dominant trees
longleaf pine
pond pine
loblolly pine
shortleaf pine

Understory
turkey oak
blackjack oak
sand post oak
dwarf live oak

Shrubs
yaupon
gallberry
fetterbush
blueberry

D. Oak-Gum-Cypress

Dominant trees
tupelo
baldcypress
water oak
willow oak
cherrybark oak
live oak
green ash
red maple
black willow

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Major Forest Types of North Carolina

Understory
water hickory
Nuttall oak
sugarberry
hackberry

Shrubs
poison ivy
trumpet creepe
yaupon
titi
possumhaw
giant cane

Lesson 3

Stewardship

HOW CONVINCING ARE THE FACTS?

TIME: 1 Hour

OBJECTIVE: To understand the difference between emotional argument and factual argument in decision making.

MATERIALS: Information about a forest's contribution to the environment
Role-playing handouts
Writing materials

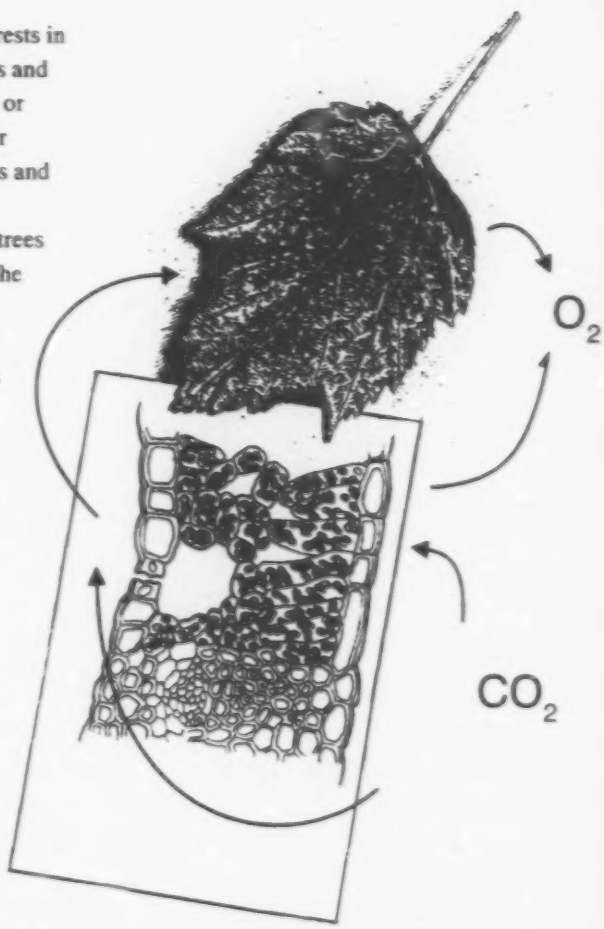
BACKGROUND:

We all have different opinions about the present and future of forests in North Carolina. These opinions are influenced by our past experiences and whether we are rural residents who see forests as sources of livelihood or wildlife refuge, or we are urban dwellers who view forests as places for recreation. Our opinions are also the result of our knowledge of forests and their role in our natural environment.

We benefit from forests, from the wildlife habitat created by the trees and plants, and from the cleaner air and water that is a direct result of the forest environment.

By exchanging gases and by catching pollution on their leaves and bark, trees and plants cleanse the air we need to sustain life. Trees and plants create the oxygen needed by humans by converting the carbon dioxide which we exhale into oxygen. Trees and plants remove many airborne pollutants. Common pollutants include man-made auto, heating and industrial emissions and naturally caused ozone. Trees can remove such natural pollutants as dust by catching it on their leaves and bark. This is evident from the appearance of trees near unpaved roads or construction sites.

Through the process of transpiration, trees cleanse and cool the environment by absorbing gases and "sweating" moisture through their leaves. In this manner, a large shade tree can "sweat" 100 gallons (860 lbs.) of water on a hot summer day. Trees further contribute to the environment by absorbing and filtering water that is seeping through the soil, thus cleansing the water of pollutants before it reaches the ground water or another water source. A healthy, large, leafy tree can absorb 2000 lbs. of water from the soil every day.



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Plants transform carbon dioxide to oxygen through photosynthesis

A good understanding of the benefits provided by trees and plants allows informed citizens to make wise decisions about the use and preservation of forest resources. Wise decisions are necessary to reduce some of the conflict between population growth and the need to protect North Carolina's natural environment.

BEFORE THE ACTIVITY:

Gather any available resource information.

Prepare role-playing handouts.

LEAD-IN:

Whether a forested area is 2,000 acres or two acres, it provides some specific benefits to us. These areas clean our air and water, provide wildlife habitat, and provide us with wood and paper products.

Think of your relationship with forested areas. Consider these questions:

Do you live near a forested area?

Do you live near a park?

What benefits do you get from living near these areas?

What benefits do you receive even though you may not live near one of these areas?

Can you describe the air when you go to the beach? The mountains?

What is the difference between that air and the air in towns and cities?

If you have just one acre of trees in your neighborhood, those trees can remove ten tons of carbon dioxide from your air in one year.

What would happen to us if all the trees and plants were removed from our environment?

Let's do some role-playing.

Large shade trees can transpire as much as 100 gallons on a hot summer day.

BUILD IT WHERE? (for three players)

Speaker #1: Guess what? I heard the city is going to build a new school over near Holden Creek Park.

Speaker #2: Really? I wouldn't mind going to a new school. This building is old and I'm tired of going to class in a trailer.

Speaker #3: Wait a minute! What about the trees and the plants that will be cut down? What about the animals? Won't everything be ruined forever?

Speaker #2: Wow, I hadn't thought about that part of it. Maybe they shouldn't build it. After all, I heard you can't replace a park.

Speaker #1: C'mon. It's just trees and bushes. What have they got to do with us?

Speaker #3: I don't know. I think it's important to have green things, but I can't remember exactly why they're important.

ACTIVITY:

1. After the role-playing, ask "Would this conversation be different if the people had scientific information about forests and trees?" Option - Make up your own skit - Each group member have a role. —developer , —concerned neighbor , —Realtor, —fast food "restaurant" food owner, —naturalist.
2. Of the statements made during the role-playing, which statements could have wrong information? (Each statement could have misinformation.)
3. Divide class into small groups and have groups rewrite the play with correct information.
4. Repeat the role playing with the revised dialogue.
5. When arguments are made about the environment, what role does emotion play in the argument? What role does science play? What role does economics play?
6. Are you more likely to believe an emotional argument or a factual argument?

BRANCHING OUT:

1. Ask students to read the newspaper or magazines and bring in articles about environmental issues. Are the arguments emotional or factual?
2. Have groups write the dialogue for role-playing about the newspaper or magazine articles. Based on the role-playing, what decisions would the students make? Do students respond with "NIMBY" (not in my backyard)?

Lesson 4

Trees

WHAT'S THE USE?

TIME: 1 Hour

OBJECTIVE: To introduce the concept of trees as a renewable and reusable resource.

MATERIALS: Items made from tree products

BACKGROUND:

Trees are a renewable and a reusable resource, meaning that we can replant trees and recycle tree products. This is fortunate for all of us who enjoy wood products and forested areas.

From trees, we get shade, energy for heat, chemicals for cosmetics, fibers for textile manufacturing, and wood for home building. Wood floors add beauty to a home, and warmth is added by a crackling wood fire in the fireplace or stove. Art is created from trees by woodcarvers. Red maples add brilliance to fall and the flowering dogwood reminds us of rebirth in the spring. Tree products such as bark, mulch, pinestraw and timbers help us create decorative landscapes.

Recycling paper that is made from raw materials provided by trees is an example of how trees become a reusable resource. Thirty percent of everything we throw away is paper, and fifteen percent of this is newspaper. Each ton of recycled newspaper saves seventeen trees. One issue of the Sunday *New York Times* uses 65,000 trees.

Recycling paper has other benefits, as well. Forty percent less energy is required to make paper from recycled products rather than from raw materials. Paper that is recycled does not take landfill space that is becoming increasingly scarce and, in turn, saves forested areas that could become a future landfill.

At the present, however, only about thirty percent of paper produced is being recycled.

BEFORE THE ACTIVITY:

THE USE:	
varnishes	boxes
soaps	farm tools
dyes	flooring
drugs	furniture
crayons	plastic
sugar and syrup	cellophane
charcoal	photo film
pine oil	glue
chewing gum	rubber
perfume	cider
flavorings	many others

Framing Lumber
Southern Yellow Pine
Douglas Fir, Spruce, Fir

Bowling Pin
Maple, Beech

Furniture
Oak, Poplar, Ash,
White Pine

Barrels
White Oak

Railroad Ties
Low quality hardwoods:
Oak, Hickory, Gum

Baseball Bats
Ash

Musical Instruments
Spruce-Veneers
Ash-Necks
Tropical Hardwoods

Books/Paper products
Hardwoods/ Maples,
Gums, Oak, Poplar,
Southern Yellow Pine,
Spruce

Tool Handles
Ash, Hickory, some
mixed hardwoods

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Select products made from tree materials. Products could be charcoal, tar, paper, pencils, pieces of furniture, toys, cardboard, artwork, fuel, home-decorating items, or boats. Include items that can be recycled and items that are made of recycled materials.

LEAD-IN:

Trees provide many benefits for people and wildlife. People use both the tree and tree by-product. Wildlife receive shelter and food from trees, both while the tree is alive and dead.

Even though trees are a renewable resource, we must be conservation-minded. New tree growth takes resources and time. One of the best ways to be good forest stewards and to be conservation-minded is to recycle. Recycling makes trees not only renewable resources but reusable resources.

Recycling paper may be the most effective long-term conservation of forest resources. It can also improve our home environment in many different ways including using newspaper mulch in the garden. Recycling can extend the life of our landfills so that existing forest and farmlands can be maintained instead of being converted into new landfills.

ACTIVITY:

1. Choose a panel of three to five students.
2. Have each panelist select a tree product item. Instruct panelists to conceal the items from the rest of the class.
3. Allow panelists to study their products.
4. Have each panelist give a three-word description of individual items.
5. Give the class 2-3 minutes to question each panelist, and then allow several minutes for the students to guess the item and the tree producing it, if possible.
6. Panelists should be allowed only yes and no answers.

BRANCHING OUT:

1. A group of people who made their living in the North Carolina forests in the 1700s were called "piney woods people"; they made tar for ships. Students could research these people.
2. Learn about paper recycling in your area. If possible, tour a recycling plant.
   a. How many tons of paper are recycled in your county each month?
   b. How many pounds per county resident is this?
   c. Weigh the paper your class uses each day or week.
   d. How much is this per student?
   e. How much paper would you calculate your school uses each year?
   f. How much paper does your family use each day or week?
3. Explore the carbon cycle. On a global scale, how do trees play an important role in collecting and transforming carbon?
4. Use "Amazing Tree Facts" handout (pages 15-16) to calculate how many acres of trees are necessary to provide the fossil fuel needs for the class as a whole or for individual students.
5. Begin recycling in the classroom. Something as simple as using both sides of a sheet of paper is a beginning.
6. Explore the papermaking process or the chemical refining process for making rayon from wood.

A Week's Worth of Paper
How much paper and/or forest products do you use? How about your family? per day? per week per month? per year?

AMAZING TREE FACTS

A mature tree removes 48 pounds of carbon dioxide (CO_2) per year from the air (roughly 10 tons per acre).

The amount of carbon stored annually by an acre of trees is approximately equal to the amount released by burning 1,000 gallons of gasoline.

A tree that provides shade and wind protection to buildings can indirectly cause, via energy conservation, reductions in carbon dioxide emissions equal to 15 times the amount of carbon dioxide the tree will absorb.

(from Journal of Arboriculture V. 16(6) 1990 p. 144)

One acre of trees annually consumes the amount of carbon dioxide equivalent to that produced by driving an average car for 26,000 miles. That same acre of trees also produces enough oxygen for 18 people to breathe for a year.

A deciduous tree, like the American beech, that is 80-100 years old has about 1,600 square yards of leaf surface area to which dust particles can adhere.

A healthy tree stores about 13 lbs. of carbon each year, and a healthy acre of trees can store 2.6 tons of carbon a year.

It takes the wood from a 100-foot tree to keep the average American supplied for a year with newspaper, books, magazines, tissues, paper towels, housing materials, furniture, desks, fences, boxes and other assorted wood products. On the average that use amounts to

- 613 lbs. of paper products
- 200 square feet of 1" thick lumber
- 87 square feet of plywood
- 59 square feet of insulation board, particle board and hardboard

Vital statistics for that 100-foot tree:

- 18" in diameter at the base
- 100 feet tall with a 60-70 foot crown spread
- weighs about 4,100 lbs. at harvest
- grew 200,000 leaves @120 lbs. per year or 3,600 lbs. over its lifetime
- 1,300 lbs. of roots (an additional 2,000 lbs. were grown and discarded)
- 100 lbs. of nutrients retained in the wood (twice that amount were returned to the soil)
- took up over 5,000,000 gallons of water from the soil and transpired it into the air; 350 gallons of water (2,900 lbs.) were retained
- 6,000 lbs. of oxygen given off

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TREE QUIZ

1. Ships were first made with wooden planks about 3000 B.C. by (a) Phoenicians; (b) Greeks; (c) Egyptians?
2. Elm logs were used by the Romans as piles (which were found to be still intact during a refurbishing project in the 1960s) in the construction of the original London Bridge. The Venetians also built their city on elm logs because (a) elm trees were plentiful; (b) elm wood does not rot in water; (c) the logs were lighter to transport.
3. The process of making paper from wood was invented in 105 A.D. in what country?
4. "Softwood" and "hardwood" refer to the degree of hardness of the wood; true or false?
5. Which man-made fabric is produced from wood pulp: (a) nylon, (b) acetate, (c) rayon, or (d) orlon?
6. Can you name the lightest wood?
7. Cork grows on trees; true or false?
8. Bamboo is a tree; true or false?
9. Which wood was used in Stradivarius violins? (a) spruce; (b) birch; (c) pine.
10. What is the origin of the saying "touch wood" or "knock on wood"?
11. What country is the leading producer of lumber in the world: (a) Russia, (b) United States, (c) Canada?
12. Every year nearly 40,000 square miles of forest are cut down worldwide. How much of that is replanted with new trees? (a) One-third; (b) one-half; (c) three-quarters.

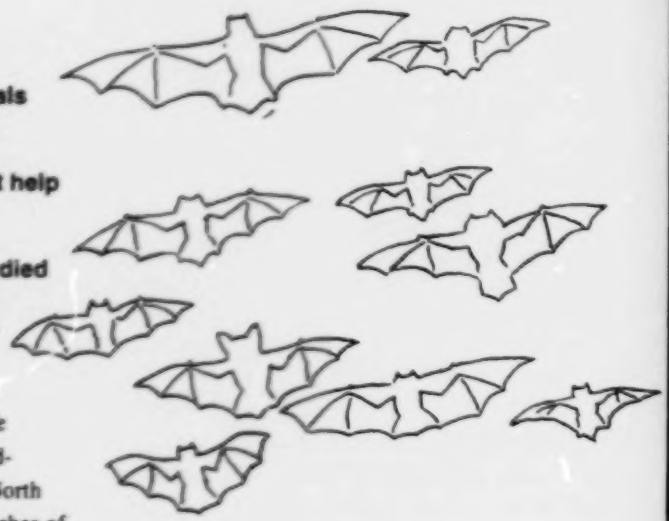
1. (answer: (c) Egyptians) 2. (answer: (b)elm wood does not rot in water) 3. (answer: In China by Ts'ai Lun, the Emperor Ho-ti's minister of public works, out of the inner bark of the mulberry tree.) 4. (answer: false. The terms refer to the type of tree. Softwood comes from cone-bearing trees such as pine and spruce. Hardwood comes from deciduous trees, which lose their leaves in the fall.) 5. (answer: (c) rayon) 6. (answer: balsa) 7. (answer: true. The bark of the cork oak is stripped about every 8 to 10 years to harvest cork. As early as 400 B.C., Romans wore cork sandals and used cork to float fishing nets.) 8. (answer: false. Bamboo is a grass.) 9. (answer: (a) spruce, because of its' great sound quality.) 10. (answer: In ancient times, certain trees were worshiped. For example, in Greek mythology the oak was sacred to Zeus, while in Scandinavian lore the ash was sacred to the Norse god Thor. It was believed that the way to avoid punishment from the gods for boasting or to gain good fortune was to touch one of the sacred trees. In time, this evolved to the belief that any piece of wood would do the trick.) 11. (answer: (b)United States; Russia is second and Canada is third. However, Russia is home to the world's largest softwood supply.) 12. (answer: (a) One-third of the world's forest are replaced by planting trees. The remainder is left to regenerate naturally.)

Courtesy of the New York Times.

Lesson 5

Wildlife

SHARING SPACE WITH WHAT?



TIME: Two 1-hour sessions

OBJECTIVE: To explore the habitat needs of specific animals and to dispel frequent misconceptions about these animals.
To create an awareness of how animals might help humans.

MATERIALS: Background information on animals to be studied (example page 20)
Writing materials, possibly drawing materials

BACKGROUND:

North Carolina's geographical location creates numerous wildlife habitats thus allowing a species diversity that is unequaled in other mid-Atlantic states. Because of the convergence of two climatic zones in North Carolina, the lower reaches of Northern species and the uppermost reaches of many Southern species can be found here. Additionally, according to the U.S. Fish and Wildlife Service, North Carolina is the fifth leading state in numbers of endangered plant and animal species in the southeastern United States.

Not all wildlife species are liked or considered friendly nor are all species understood. Species such as snakes, owls, bats, and hawks are frequently viewed as dangerous or ugly. This impression can be the result of insufficient knowledge or folk/old wives' tales. Snakes, which are much maligned, help control the rodent population. Bats are good for North Carolina's environment because of the quantity of insects that they eat. Owls and hawks eat rodents and sometimes snakes, but when owls and hawks occasionally eat domesticated animals, they conflict with humans.

Even though conflicts with wildlife do arise, humans have a responsibility to identify and protect wildlife habitat. This responsibility begins with learning about wildlife and its relationship to the human environment. This education could begin with learning that snakes need shelter from the cold. Bats, too, need shelter in the winter when food sources are low. Owls and hawks are both hunters, but owls are night-hunters, while hawks hunt during the day.

Increased knowledge about wildlife and a greater awareness of habitat needs help not only animals but also humans, who benefit from wildlife existence.

BEFORE THE ACTIVITY:

Review resource information about wildlife.

Bring in a bat box, if possible. (See example on page 19.)

Collect myths about misunderstood animals.

LEAD-IN:

Do you know that some people believe that bats are vampires, and other people believe all snakes are aggressive and dangerous? Do you agree with these people? You shouldn't.

We can begin by trying to answer some questions.

Snakes often sleep on sun-warmed rocks or hide under logs. How could this cause problems for people?

Hawks hunt by day; owls hunt by night. What problems could this cause?

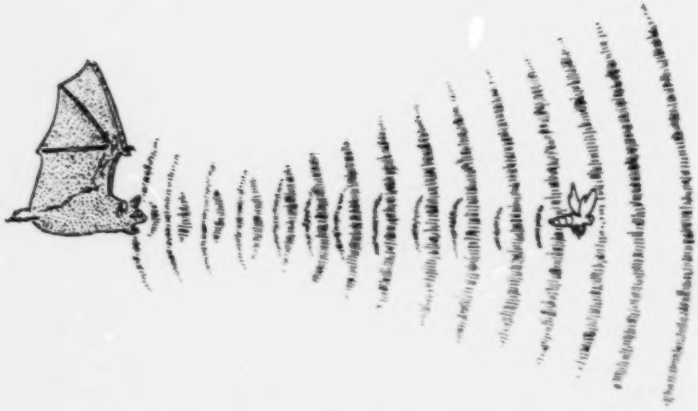
Bats fly at night and are attracted by certain sounds.

What types of habitats do you think these animals need for survival?

How can we help other people understand snakes, bats, owls, and hawks?

ACTIVITY:

1. Begin by exploring myths that surround animals.
2. Ask for examples of stories students have heard. Ask the students to identify the setting of the stories. Were the people in the animal's territory, or was the animal in the human's territory?
3. Ask what experiences students have had with "wild" animals.
4. Distribute resource material for background information. This material should show where animals live, what needs animals have, and how animals benefit the human environment.
5. Ask students to produce a public service announcement for television that shows the positive features of an animal and helps dispel the myths.



BRANCHING OUT:

1. Students can create tabloid-type headlines about animal myths and explain why the headline is not true.
2. After learning how animals help the environment and people, students may write short stories focused on what they have learned.
3. Invite a wildlife enforcement officer to speak about human and wildlife contact or wildlife rehabilitators to speak about their organization. Ask them to speak about misconceptions about certain animals.
4. Students can build a bat box.
5. Take a trip to a natural history museum and talk with a herpetologist or other animal specialist.

Resource Example: BAT FACTS

Order: Chiroptera

- Vision is poorly developed.
- Hearing is an echoing device to locate food sources.
- Ultrasonic sounds are emitted through the mouth or nose and returning echoes received by the ears allow the animals to determine location, size, distance, and speed of nearby objects.
- The bats of the Carolinas and Virginia are insect-eating. Their food supply is often unavailable during the winter. The bats hibernate or move to warmer climates. Hibernation is usually in caves.
- Bats affect humans in the Carolinas and Virginia by eating insects: one bat will eat thousands of insects in a day.
- Bats are the only mammals capable of sustained flight.

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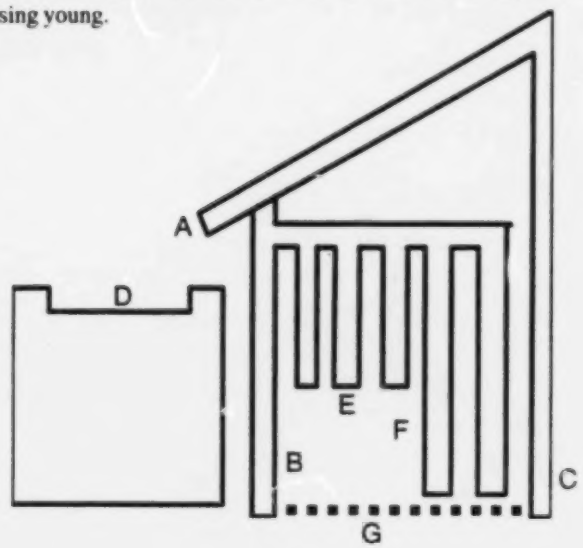
BAT HOUSES

Bats spend over half their lives in roosts and rely on sheltered, undisturbed natural sites such as caves, crevices in rocks, and tree cavities to meet their needs. During winter months, insulated roosts are important for hibernating bats; in late spring and early summer, roosts that can sustain daytime temperatures between 80 and 90 degrees Fahrenheit are important for raising young bats. Bats are opportunistic in their roost selection and will utilize man-made structures where natural roosts are unavailable.

Properly constructed artificial roosts may be installed in areas where natural roosts are scarce or absent. Solitary species such as the hoary bat will not use bat houses consistently as will colonial bats which include the little brown bat, big brown bat, red bat, and Eastern pipistrelle. Use the following diagram to build effective, maintenance-free bat houses for roosting and raising young.



Plans for constructing a bat house

Dimensions
A Roof 16 1/2" X 11 1/4"
***B Front 18 1/4" X 9 1/4"**
C Back 27" X 9 1/4"
D Ceiling 9 3/4" X 9 1/4"*
E Partition 9 1/4" X 8"
F Partition 9 1/4" X 14"
G Sides 11 1/4" wide,
27" back,
18 3/4 " front

Spacing between partitions (front to back):
3/4", 3/4", 3/4",1", 1 1/2", 1 1/4"
* Insert cut 1 1/4" X 6 1/4"

Construction Tips:

***Use cedar, cypress, or pressure-treated pine lumber to ensure durable, longer-lasting boxes.**

***Use rough lumber, cut shallow grooves, or attach fine plastic or wire mesh to the inner surfaces of the box so bats can easily crawl up and into the house.**

***Avoid painting or varnishing the inside of the house.**

***Paint or cover the roof and the top four inches of the sides with tar paper or another dark material to ensure the high temperature ranges required by both young and adult bats.**

***Seal all seams with silicone caulk to waterproof houses and prevent heat and moisture losses.**

Installation Tips:

***Place bat boxes close to rivers, lakes, ponds, marshes, or other permanent water sources where insects are abundant.**

***Secure boxes to the sides of trees with a ten penny nail or with crimped wire that can be loosened as the tree grows. Boxes mounted on fast-growing conifers may have to be remounted every two to three years.**

***Tilt houses at a 10 degree angle to help young bats stay in the box.**

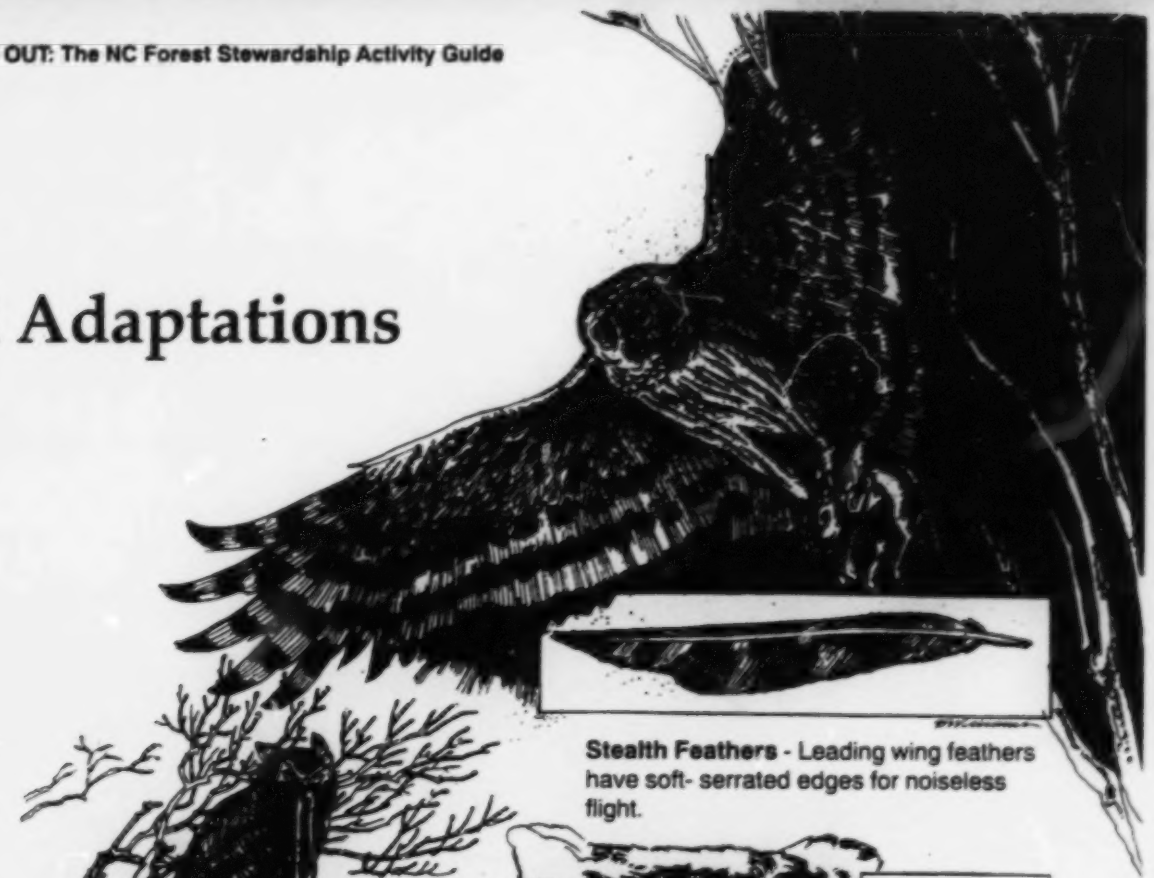
***Place bat houses ten to fifteen feet off the ground.**

***Locate boxes where they will absorb maximum sunlight. Where possible, place four boxes per tree, facing north, south, east, and west, to allow the bats to choose the box they need.**

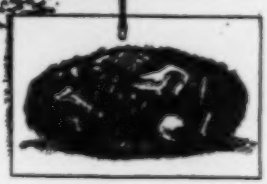
***Install bat houses by early April, but bats may not use the houses immediately. A Bat Conservation International (BCI) survey showed a 52% occupancy rate for all boxes. Bats may take up to two years to find and begin using artificial roosts.**

***Inspect bat houses annually and remove any vegetation that could interfere with entry to the roost or allow access to predators. Attach predator guards or roofing tin onto the mounting post or tree three feet off the ground to protect roosting bats from predators such as house cats, raccoons, and snakes.**

Owl Adaptations



Stealth Feathers - Leading wing feathers have soft- serrated edges for noiseless flight.



Regurgitation - Owls absorb nutritious foods through stomach walls but regurgitate "pellets" of indigestible hairs, feathers, bones, and claws.

Large Retinas - Vision is 50-100 times better than humans in poor light.

EYES

Many Rods - High concentrations of rods (light gathering cells).

Binocular Vision - Fixed eyes view the same scene from slightly different angles improving depth perception.

Large Head With Wide Ear Epacing - Disk-like design receives sound at minute thresholds; large ear openings and asymmetric ear positions improve hearing.

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Lesson 6

Soil & Water

POINT TO A PROBLEM: POINT TO A SOLUTION

TIME: At least one session

OBJECTIVE: To understand the sources of water pollution. To understand how forests are a part of the solution to water pollution.

MATERIALS: Handout (page 23)

BACKGROUND:

Water pollution originates in many ways and can be designated as point source or nonpoint source. Point source pollution comes from a specific place such as a drain or pipe; nonpoint source pollution results from conditions such as runoff of soil from construction or from fertilizer or pesticide runoff.

Industrial waste water that is flushed into a stream or lake is an example of point source pollution that could raise the temperature of water. This temperature pollution disrupts the ecosystem and the breeding conditions necessary for aquatic life.

The nonpoint source water pollution resulting from fertilizer or herbicide/ pesticide runoff also disrupts the aquatic ecosystem. Excessive nutrients (fertilizer) washed into water can cause an explosion in algae growth. This abundance of algae blooms (grows) and then dies. The decaying dead algae consumes the available oxygen in the water suffocating other marine life. Herbicide and pesticide runoff create a condition of "clear water" or water free of vegetative life. This disruption of the aquatic ecosystem leaves fish life without a food source.

BEFORE THE ACTIVITY:

Have resource information available for students.

If the class will take a "Spot" walk, obtain the necessary permission and prepare maps of the area for walkers.

Pollutants

Sediment

Organic Matter

Plant Nutrients

- **Nitrogen**
- **Phosphorus**

Pesticides

Bacteria

- **Fecal coliform**
- **Fecal streptococci**

Alkali-earth Metals

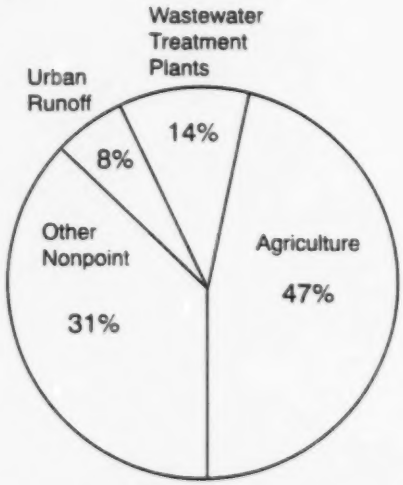
- **Boron, Zinc, Cadium**

Copper, Mercury, Chromium, Lead

Other Metals

- **Iron, Aluminum**
- **Manganese**

Oil and Grease



Pollution Sources

Source: Land Use and Water Quality NCCES, 1992. T. J. Hoban and M. G. Cook and F. J. Humenik.

LEAD-IN:

Water pollution occurs when too much of something is produced and the ecosystem is thrown out of balance. What do you think are some of the causes of water pollution?

Scientists classify water pollution as being point source or nonpoint source. What do you believe these terms mean?

We can get a better idea of the meaning of these terms if we list different kinds of water pollution and try to decide if the pollution is from one target source or from a general vicinity.

ACTIVITY:

1. Refer to students' list of water pollutants and possible sources of pollution.
2. Pass out handout (page 23).
3. Have students re-evaluate their list of pollution sources.
4. Ask students to consider where pollution could come from in their homes.
5. Consider where pollution might come from in town.
6. If possible, take a "Spot" walk to look for point source or nonpoint source pollution. Be certain to instruct walkers to wear appropriate shoes and clothing and to practice safety. Also remember to "take nothing but pictures and leave nothing but footprints."—or—Take a "Spot" walk in or around the home or school.
7. Ask walkers to identify natural elements such as good root systems or swiftly running creeks that might help reduce water pollution.
8. After the walk, ask for suggestions to limit some of the pollution found.

BRANCHING OUT:

1. If your county has a hazardous waste disposal day, obtain permission for the class to participate and help.
2. If the county does not have such a day, try to organize one.
3. Invite the county engineer or planner to discuss the area's storm water regulations.

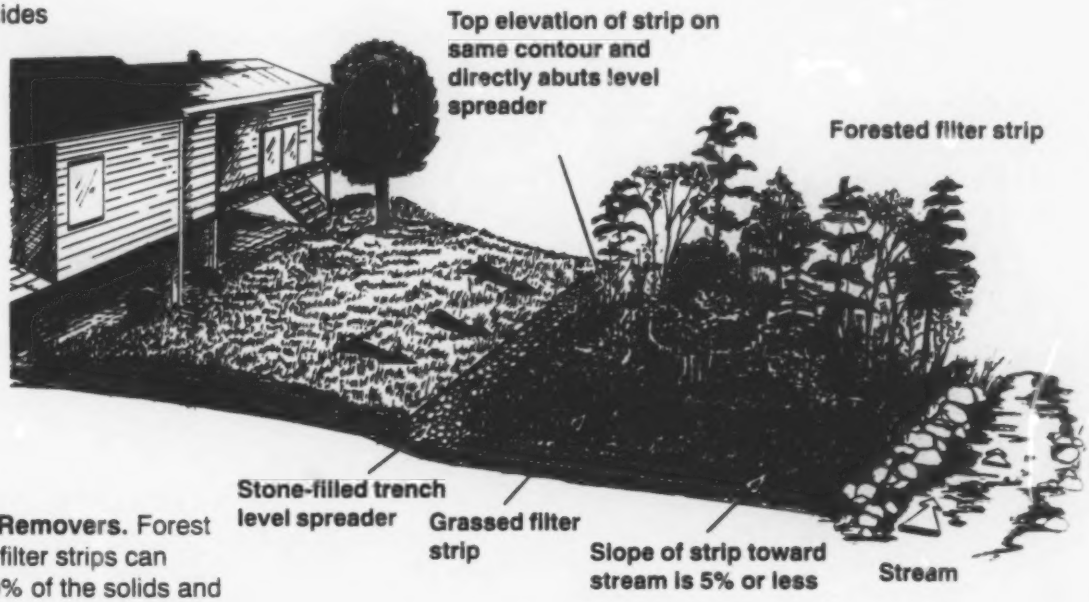
Nonpoint Pollution Sources

Commercial/Industry -
Wastes

Roads -
Construction
Paved runoff
Oil and grease
Salts

Residence-
Pesticides
Nutrients
Soaps - Phosphorus
Lawn

Farms -
Livestock
Sedimentation
Fertilizer
Pesticides


Top elevation of strip on same contour and directly abuts level spreader
Forested filter strip
Stone-filled trench level spreader
Grassed filter strip
Slope of strip toward stream is 5% or less
Stream

Pollution Removers. Forest and grass filter strips can remove 60% of the solids and 40% of the nutrients in urban runoff.

Lesson 7

HABITAT: HEALTHY OR HURTING?

TIME: 1 Hour

OBJECTIVE: To understand the carrying capacity of land and the necessity for managing forest cover.

MATERIALS: Grocery bags or boxes
Canned food or cutouts of food from magazines
Markers and large labels

BACKGROUND:

The health of a forest and its wildlife inhabitants can be encouraged through good forest cover management and a determination of an area's carrying capacity.

Carrying capacity, the number of living things that can be supported by a certain amount of land, is usually stated by the number of acres needed to sustain a type of animal such as deer. Humans rarely think of carrying capacity since they are able to bring resources to their home, but the concept is crucial to wildlife and plant life.

Carrying capacity and wildlife sustainability are influenced by natural conditions and human intervention. Wildlife populations generally fluctuate around changing natural conditions. If a food source is plentiful, animal populations will grow, but this growth becomes problematic if the animals have no natural predators in the area. A herd of deer with a good food source but no predators will grow unchecked until the habitat is destroyed and the deer succumb to disease and starvation.

Climatic changes such as drought, too much rain, or temperature extremes or fluctuation can influence plant growth preventing grazing by herbivores. If herbivores die, carnivores suffer. Conversely, too many herbivores can overgraze an area, leaving the animals without a food source.

Decomposers, naturally occurring microorganisms, play a part in carrying capacity by acting upon dead plants and animals. Their actions help to maintain a balance in nature.

Human intervention in the form of forest management through thinning, replanting, harvesting, prescribed burning, and vegetative control can increase carrying capacity. For instance, removal of trees or plants through harvesting or thinning allows the regeneration of low vegetation that is a food and cover source for wildlife. The amount of scarce or nonexistent wildlife

can then increase. Other management practices and results can include the following:

Action	Result
plant food plots	increase food source
thinning/harvesting/ prescribed burning	increase food source
fertilize existing cover	increase quality/ quantity of food
dig small ponds	water source
build brush piles	increase cover
erect nest boxes	increase cover

Carrying capacity extends beyond wildlife considerations; it refers also to the number of trees that an acre of land can support. This determination allows foresters to schedule effective thinning operations. Otherwise, trees would die from the natural competition for sunlight, water, and nutrients.

BEFORE THE ACTIVITY:

Make an animal label for each student. Mark some of the labels young, some old, male, female, female with young, strong, weak, or injured. Labels may name specific animals who require different foods. For example, rabbits eat fresh vegetables while cardinals like sunflower seeds.

LEAD-IN:

Suppose that all the people on your block had to live in only two small houses. What might happen?

Suppose that the trucks that bring food to the grocery stores stopped running. What could happen?

Situations like this can happen in the wild. Animals can be faced with too little food if a cold spring damages plants. Homes and food sources can be destroyed by a forest wildfire.

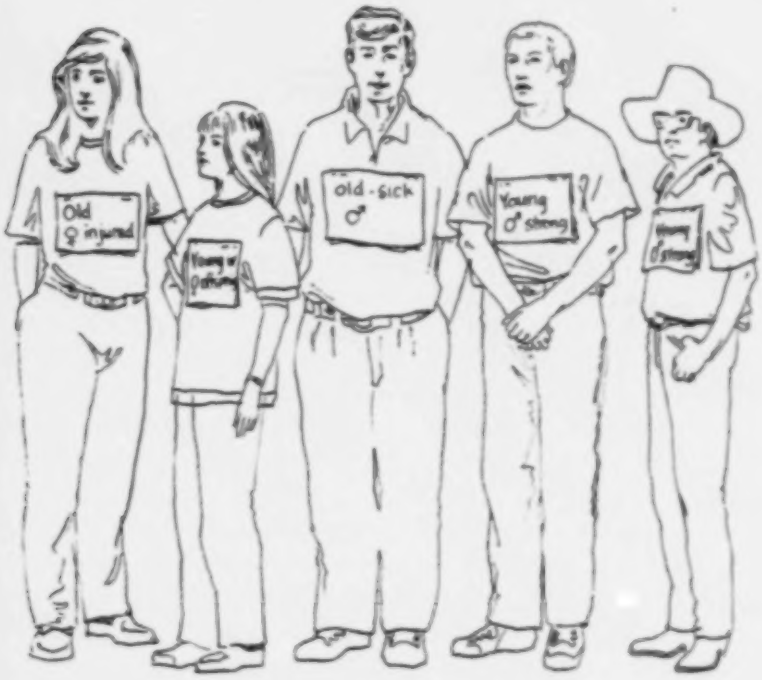
We're going to try two exercises that show us how changes can affect not just one species, but all species. And, we're going to look at how we might allocate (share) resources.

(This activity is appropriate for all ages, but if it appears too young, students could research individual types of animals and their food source.)

ACTIVITY:

1. Distribute labels to students.
2. Have two bags or boxes of groceries with fewer groceries than students.
3. Announce that there is food for the animals in the bags or boxes. Some of the food could be tainted or toxic, but the animals may not know this.
4. If you have different types of animals, some food may be used by certain types but not by others.
5. After the food is distributed, who remains unfed? What would likely happen to them?
6. Reenact this scene with the introduction of a natural predator and/or a human. The predator could "kill" an animal by tagging it or the prey could escape. The human could "kill" the animal, watch it, or take food to it. The human could eat the food intended for an animal.

Have the class decide upon the rules.

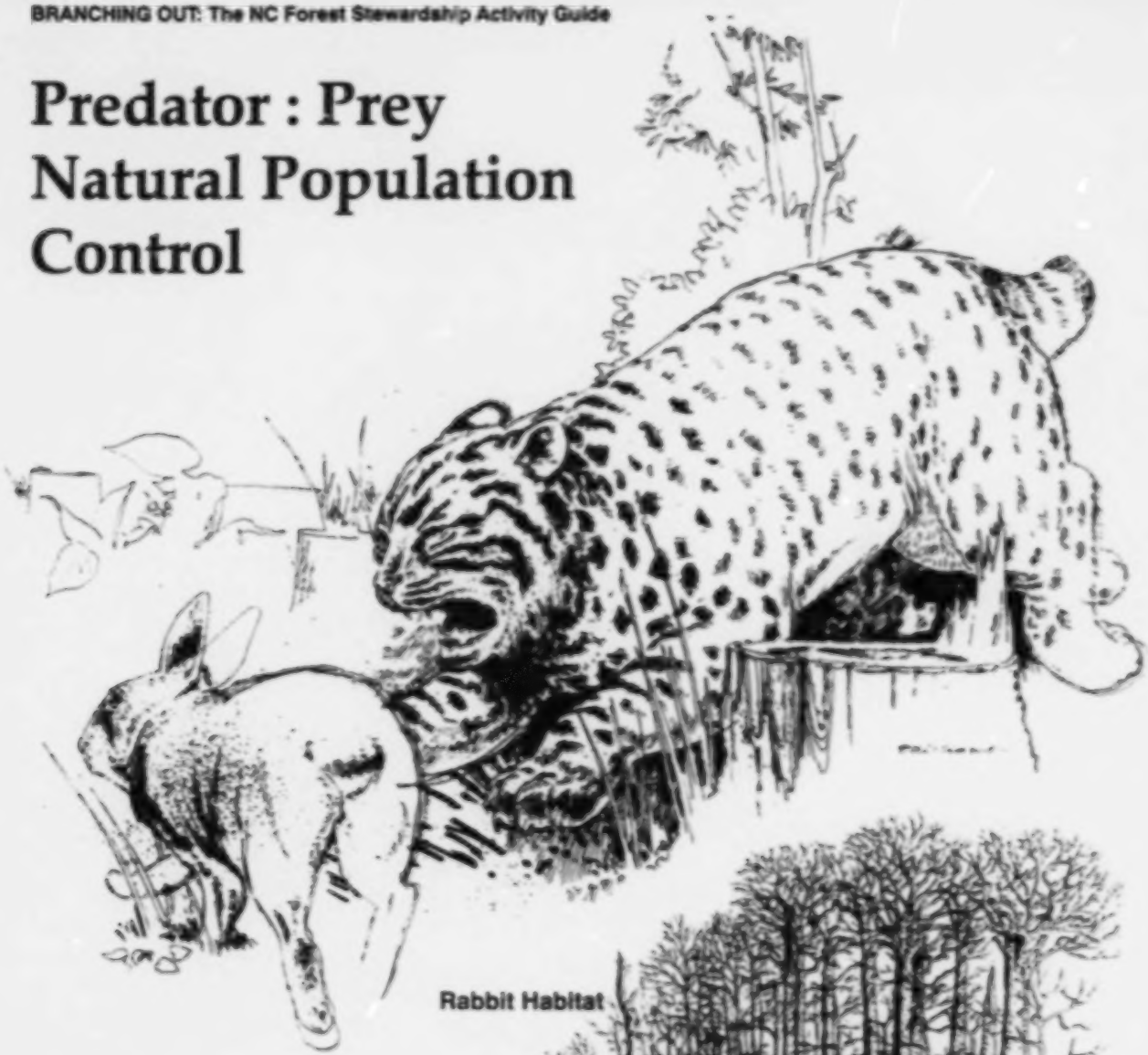


Natural Balance: Resources don't seem limited to humans because there is always more food, fuel and shelter to be had if you have the money to acquire it. Playing the carrying capacity game can help students understand "limited resources" first hand.

BRANCHING OUT:

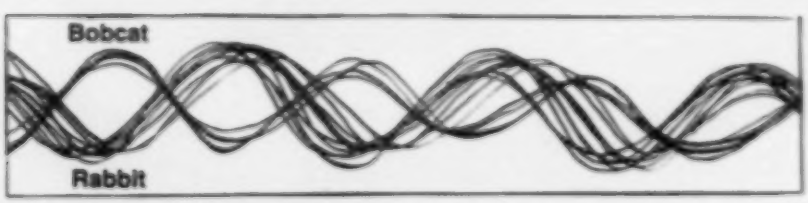
1. Have students research vegetation carrying capacity. They may answer questions such as which types of trees can crowd other types of trees? What types of vegetation come back first after a fire?
2. Consider how human behavior could affect animals' food sources. What would be a positive way? A negative way?
3. How can setting aside certain lands help or harm animals?
4. What do people give up when they set aside land for animals?
5. List forestry and wildlife techniques that increase carrying capacity.
6. Give pro's and con's of the following activities: fertilization, prescribed burning, harvesting, road construction, food plots, putting up nest boxes.
7. How can students increase the carrying capacity of their backyards, school grounds, community parks and stream edges? What volunteer groups could help students? (Audubon Societies, Ducks Unlimited, Quail Unlimited, National Wildlife Federation, North Carolina Wildlife Federation)
8. Visit a stand of thick pine that has never been thinned. Observe what other types of growth are and are not there.

Predator : Prey Natural Population Control



Suitable Habitat. Rabbits need young, recently disturbed or abandoned cropland to survive.

0----------100 years
Young seedlings ----------Mature forests



Predator and prey relationship: When rabbit (prey) populations rise - the bobcat (predator) population increases to take advantage of the surplus. As rabbits decline, the bobcat population also decline.

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Lesson 8

WETLANDS MAKE A DIFFERENCE

TIME: Varies with project

OBJECTIVE: To understand the role and importance of wetlands.

MATERIALS: ***Aquatic Wild***
Project Learning Tree
Project Wild
other resource bulk or materials

BACKGROUND:

A wetland is an area such as a swamp, bog, or marsh that is covered by water all or part of the time.* A wetland may also be a meadow that has standing water after a hard rain or an area near a river that sometimes floods. Any area that is designated as a wetland has three basic characteristics: water, special soil, and specialized plants.

The water in a wetland area can be fresh, brackish (slightly salty), or salty; it can be visible or saturating the soil. Evidence of water no longer visible can be lines on trees showing how high the water has come during a wet season or during high tide.

Wetland soil and plants have special characteristics. The soil is usually anaerobic (without oxygen) depending upon how often and how long the soil is saturated. Plants, which use carbon dioxide and release oxygen, are adapted to the anaerobic condition. These adaptations can be in the form of "knees," a secondary root system above the water line or "buttresses," large swollen bases that help support the tree.

The unique soil, plants and the water of the wetland provide habitat for wildlife and aid in cleansing pollutants from the environment.

*This definition of wetlands is for educational purposes only.

BEFORE THE ACTIVITY:

Gather needed resources from the library plus resources such as *Project Wild* and *Project Learning Tree*. Lists of materials for the various activities are provided in these resources; either assemble the materials or instruct students to do so.

LEAD-IN:

What do you think a wetland is?

A wetland is more than just land that gets wet. Even though we may not live near one, a wetland is important to us. It can affect our drinking

water, whether the water comes from a river, a lake, or a well. A wetland provides us with plants and animals that aren't found anywhere else (cattails, herons, turtles, cypress trees), and the plants provide food for animal life that is sometimes part of our food chain (fish and game species).

We can all enjoy the beauty of a wetland. The Everglades of Florida are a famous national wetland where people can hike or camp and watch the wildlife. Has anyone been to the Everglades?

North Carolina also has wetlands. Do you know where most wetlands are? (the North Carolina coastal plain) Or, do you know the name of a famous wetland area in North Carolina? (The Great Dismal Swamp and The Green Swamp)

A wetland is made of many different parts and each part is important to us.

ACTIVITY:

1. Divide the class into small groups.
2. Instruct each group to select one aspect of wetlands and to prepare a demonstration about that aspect. Suggestions for projects follow.
3. Groups present to other classes.

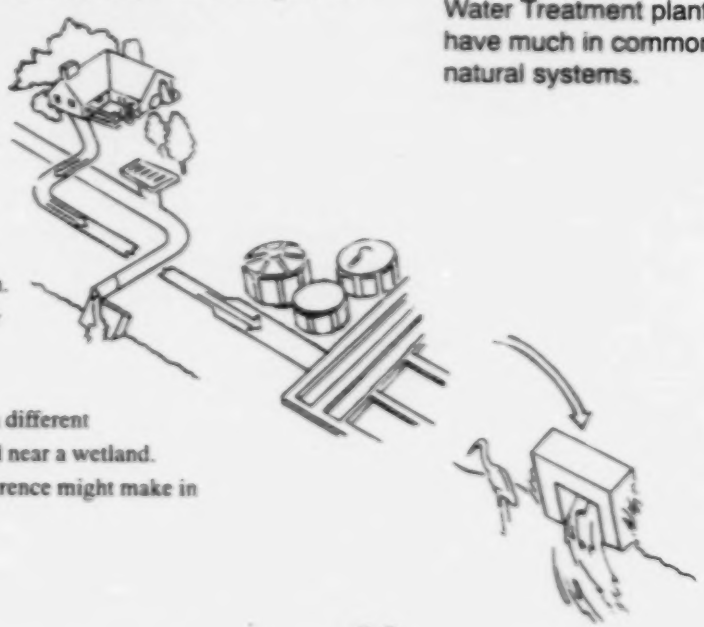
Suggestions for:

Vegetation

1. Make a field guide of plants found in wetlands.
2. Make a cookbook with recipes using plants from a wetland.
3. Construct one type of home for a particular animal such as a nest, terrarium or aquarium.
4. Find a wetland and take pictures. Identify the plants found in the picture.
5. Explore the life cycle of a beaver and its impact on trees.
6. Beaver populations are rising across North Carolina. Is this good for wetland species? For timber?

Water

1. Demonstrate the soil absorption of different types of soil.
2. Measure amounts of rainfall or runoff at a wetland site.
3. Do a groundwater demonstration. Use *Aquatic Wild* lesson "Water Wings" or "Where Does Our Water Go After School?"
4. Measure the pH of the rainfall in different areas of your town or county and near a wetland. Find out what effect the pH difference might make in plant growth.



Water Treatment plants have much in common with natural systems.

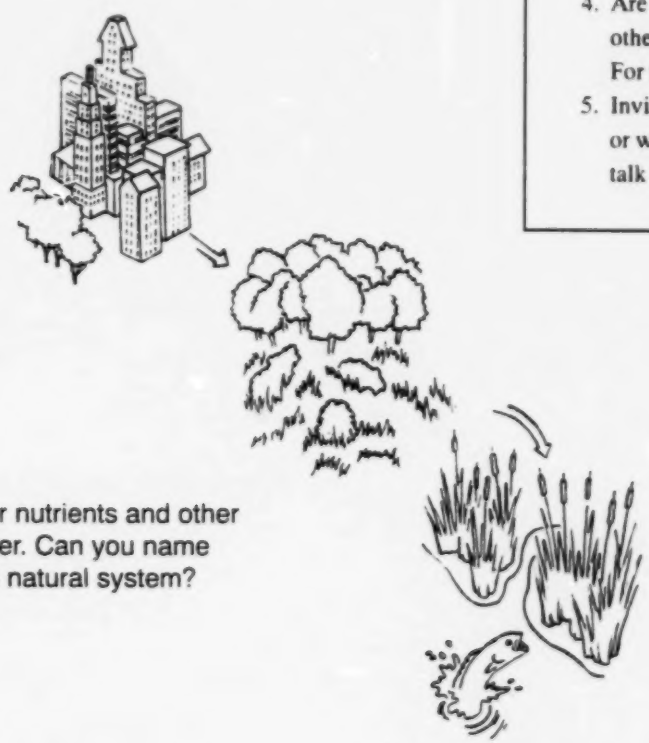
5. Show the complete rain cycle which includes transpiration and runoff.

Soil

1. Purify a glass of muddy water by pouring it through a coffee filter layered with gravel, sand, and soil. Use all three filtering materials or only one or two.
2. Demonstrate how water runs off a land surface by taking pictures of a parking lot during a rain storm.
3. Take pictures of an area of grass-covered soil during and after a rain storm. If you cannot take pictures, make up a demonstration by pouring an equal amount of water over a plain piece of plastic or wood and a piece of natural fiber such as a doormat or a piece of sod.
4. Demonstrate how water travels through soil. Then ask your audience what they think might happen if an improperly run landfill were near your water source.
5. Demonstrate the specific properties of a hydric (water saturated) soil by sealing a clump of red clay in a water-filled jar. Notice the color of the clay after a day, a week, and two weeks. The reverse can be demonstrated by allowing a clump of grey clay to air dry; the grey clay could be baked in an oven to speed the process.

BRANCHING OUT:

1. Why is the definition of a wetland so important? Follow the wetlands issue in the newspaper.
2. Research what industries or lobbying groups would benefit if wetlands had a greater or lesser definition of protection.
3. Who pays for the protection of the wetlands?
4. Are some wetlands more important than others for wildlife? For water protection? For fisheries?
5. Invite a soil conservation service district or water conservation district person to talk about hydric or wetland soils.



Wetland areas can filter nutrients and other pollutants from our water. Can you name other benefits from this natural system?

Lesson 9

Soil & Water

FIELD REPORT

TIME: 2 one-hour sessions

OBJECTIVE: To introduce the interrelatedness of water, soil, air, and forests.

MATERIALS: Large roll of paper, watercolor markers, camera and film, thermometer, small shovel, and pencils

BACKGROUND:

The quality of our environment is largely the result of actions created by forest plant life. Our planet's air supply is dependent upon the exchange of carbon dioxide and oxygen between plants and mammals. A stand of trees filters air through its leaves. Water traveling through a root system of grasses, shrubs, trees, and bushes becomes cleaner and water released by trees through transpiration cools the air. Additionally, tree leaves shelter us from the sun, help keep us comfortable, and lower our energy costs.

Trees help in other ways less noticed by humans. Root systems hold forest soil in place thus preventing widespread erosion which would, in turn, cause water pollution. Certain types of trees add nutrients to the soil allowing other plants to grow. An example is the black locust tree that can fix (add) nitrogen to the soil from the nitrogen gas in the atmosphere and improve growth in the forest community. Dead and decaying trees, too, along with shrubs and other plant and animal life nourish the soil.

Plant and animal habitats vary with the forest's location, its rainfall, temperature, and human disturbance. Moist, well-drained clay and loamy soil supports beech, cherry, elm, oak, and hickory trees. Sandy, well-drained soil supports pines and other species that can tolerate drought conditions. Mesic (medium) soil that is not as rich but receives adequate rain will support white pine, hemlock, sweet gum, and oak. Swampy or large wet areas can have cypress, gum, willow, and Atlantic white cedar.

Each forest environment creates a particular habitat for animal life.

BEFORE THE ACTIVITY:

Plan a field trip to a forested area. Try to make the trip soon after rainfall.

Arrange for a camera to use during the field trip.

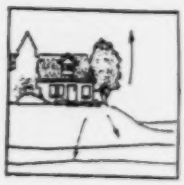
Gather examples that aid in identifying plants and animals.

LEAD-IN:

Where Does the Water Go?
Rainfall can infiltrate the soil, become runoff or be lost via evaporation and transpiration.

Forest

Rural



Suburban

Urban

Have students compare the impact of vegetative cover and human activity on water quality.

LEAD-IN:

A forest is much more than trees. What are some of the other components of a forest?

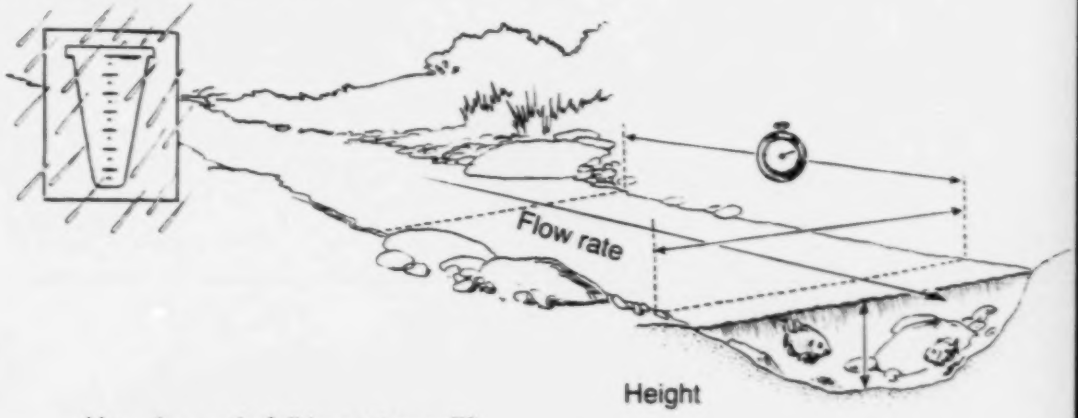
How does forest life affect us? (Trees provide oxygen, animals transport seeds, predators control rodents.) How would our lives be affected if there were no forests?

ACTIVITY:

1. Instruct students that a new housing development or industrial site is planned and they have been assigned to conduct an environmental impact study.
2. Take a field trip to a forested area with at least one acre of trees (about the size of a football field).
3. Before the field trip, have students collaborate on a simple outline map of the forest area that can be filled-in with what is found during the visit. Have each student prepare a copy of the map.
4. Assign one or two students to photograph aspects of the forest.
5. In small groups, students should walk through the forest and record what is observed such as the types of flowers, shrubs, and bushes, the types of trees and soils, and any decayed matter. Students should also note signs of animal life including feathers, fur, paw prints, droppings, or nests. Evidence of rainfall such as puddles or wet ground and streams or drainage ditches should be recorded as well as the temperature inside and outside the forested area. A soil sample could be taken from inside and outside the forest. (The North Carolina Department of Agriculture will test the sample. Contact the county cooperative extension service for information.)
6. Back in the classroom, have students study their maps indentifying what was found in the forest. What impact will development have on the forest environment; for instance, how will tree removal affect soil, water, air, and animal habitat?
7. Can the groups make suggestions to eliminate or reduce the amount of disruption the forest could experience?

BRANCHING OUT:

1. To help visualize how an area can change, choose a proposed construction site and keep a diary of environmental changes as construction takes place.
2. Research the geology of the region. What is the origin of the parent mineral material in the forested area visited during the field trip.
3. Look at old pictures of the town or county. How has the area changed?
4. Study the history of the forested area visited. Were the trees planted specifically for the area? Did the trees regenerate after a farming activity? How old are the trees. Was there a fire or harvesting to take out old trees allowing new trees to grow?
5. Ask a forester/ecologist to explain how the history of a property can be read.



How does rain fall impact runoff?

Can you use measurements to calculate stream flow?

Field Report

SOIL	WATER	TREE COVER	WILDLIFE SIGN	PLANT COVER

Field Map

Legend	Water Courses Tree Cover	Scale

THE TRAVELING WATER SHOW

Lesson 10

TIME: 2 one-hour sessions

OBJECTIVE: To introduce the concept of water resources.

MATERIALS: County maps and information about farms, housing, business, and industries in the area.

BACKGROUND:

Water covers approximately 71% of the earth's surface; about 97% of this water is in oceans while the remainder is in groundwater, lakes, rivers, and streams. Even with such an abundance, clean drinking water is not always easily available. People and governments must invest time and money treating and transporting water.

North Carolinians get water from wells and water treatment plants. Well water comes from aquifers, and geological formations containing water that lie beneath the earth's surface. Because industry and population developments draw on local aquifers, this source of water is becoming increasingly more difficult to find. Most cities in the state get their water from rivers, streams, and lakes. This water, that was in the past safe to drink directly from the source, must now be chemically purified at a treatment plant.

BEFORE THE ACTIVITY:

Obtain county maps, copy and enlarge sections of the maps to make the rivers, streams, and lakes easier to locate.

LEAD-IN:

Do you know where your water comes from? (Help students name local water sources.)

What do you think happens in a watershed area?

A watershed is much like a bathtub after a small child has taken a bath. All the child's toys and sand, dirt, twigs, and pebbles head for the drain as the water is emptied. In the natural environment, water draining into rivers and lakes picks up many things from the land.

What are some things water could pick up? (pesticides, fertilizer, oil, loose soil)

What happens after a hard rain? What do you see next to roads and streets after a hard rain?

ACTIVITY:

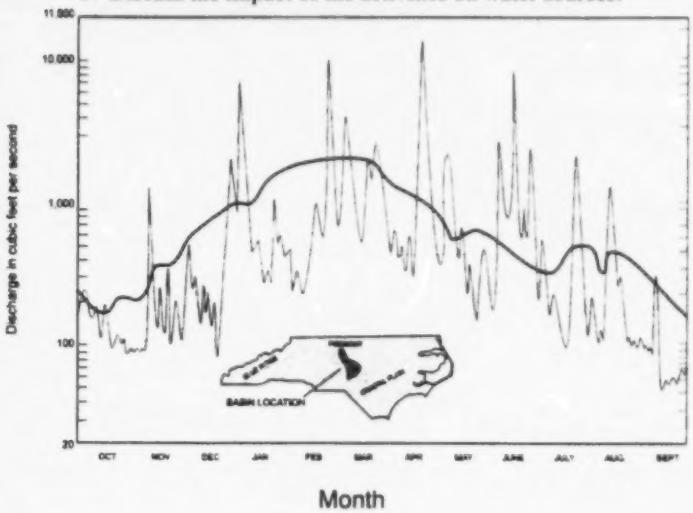
1. Divide class into small groups; give each group an enlarged map section.
2. Each group should use markers to color code rivers, streams, and lakes.
3. Instruct groups to research activities such as housing developments, industries, malls, or farming that happen near their rivers, streams, and lakes.

They may use symbols or stickers on the map to indicate the activities.

4. Groups should present their findings to the class.

They may use symbols or stickers on the map to indicate the activities.

4. Groups should present their findings to the class.
5. Discuss the impact of the activities on water sources.

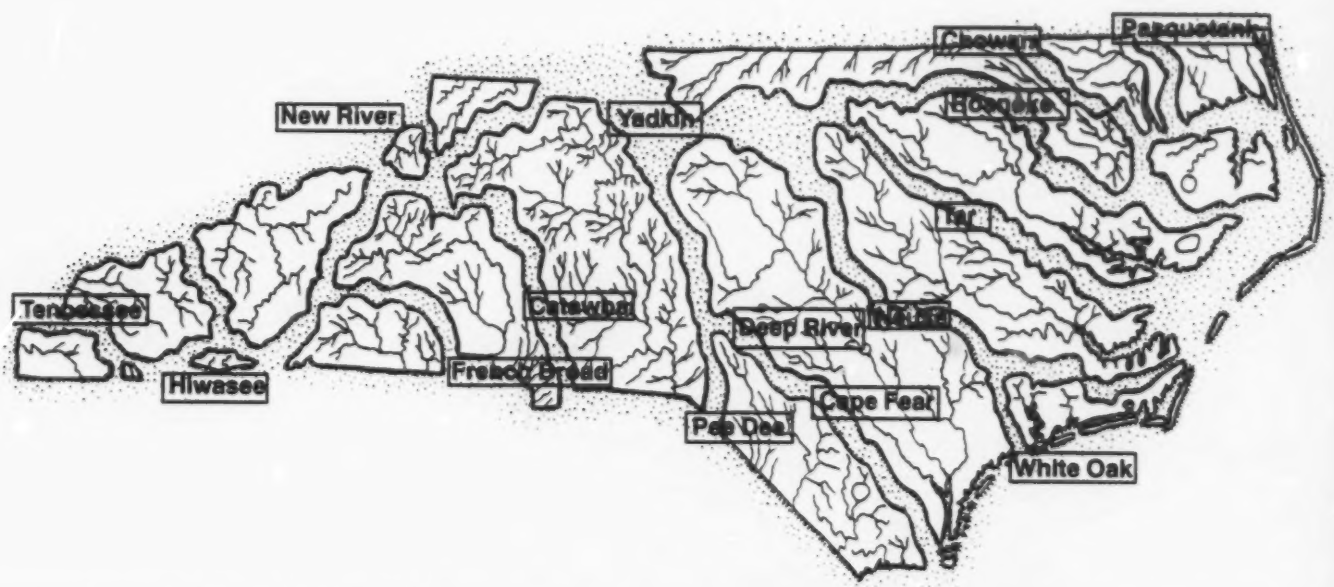


Month

Daily and median discharge for the Deep River Watershed near Sanford for the 1992 water year
Note - Peak flow (discharge) following a rain event can be 10 times greater than the average flow.

BRANCHING OUT:

1. Groups may track water from a treatment plant back to its source.
2. Activities from a broad area and their effects on a water source may be researched.
3. Research what a hydroelectric dam does to water flow in a river.
4. Identify any natural lakes in the area. How were they formed? How were the other lakes formed? (As a rule, there are no natural lakes in the Piedmont.)



North Carolina's Watersheds - There are more than a dozen watersheds in North Carolina. Can you identify the watershed in which you live? Which watersheds are not impacted by urban development, agriculture or forestry?

Discuss the concerns of downstream users.

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Lesson 11

WHO'S THERE?

TIME: Varies with activity

OBJECTIVE: To develop sensory awareness of nature.

MATERIALS: Environmental sound tapes and tape player

BACKGROUND:

The ability to be aware of our surroundings is often a learned behavior, and our innate inclination to appreciate sensory impressions created by nature is often sublimated by human-produced sights, sounds, and smells. However, a heightened sensory awareness of the natural world can be fostered and can lead to an increased ability to observe the environment. This is an important first step in developing scientific ability and in becoming a natural scientist since scientists must be able to observe what is occurring in their environment.

BEFORE THE ACTIVITY:

Either tape environmental sounds or acquire a commercial tape of nature's sounds.

Before students enter the classroom, arrange objects such as flowers, mosses, or branches around the room. Objects could be camouflaged by putting red flowers near red books or mosses in front of similarly colored objects.

Give students an opportunity to look around the room.

LEAD-IN:

Without looking around, who can describe...(name an area of the room with some camouflaged items).

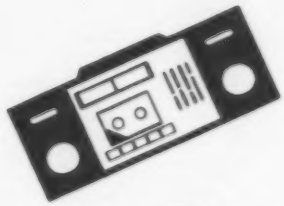
Now, close your eyes and listen for a minute. (Play the environmental sounds tape.) What did you hear? Do you think you heard more because your eyes were closed? Why?

What are you discovering from this?

Do we see and hear all that is around us?

What about our sense of smell? Can you tell what's for dinner by the odors from the kitchen? What other odors do you notice and identify?

We're going to spend some time sharpening our observation skills and becoming more aware of what nature is telling our senses. When we do this, we will be a little more like the animals who depend upon their senses for survival.



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their senses for survival.

ACTIVITY:

1. Ask students to get comfortable and play the sounds tape for five minutes; part of the time students should have their eyes closed and then opened.
2. Sit in silence for a minute.
3. Discuss the difference in what was heard while eyes were closed and while they were opened. What does this tell us about human sensory awareness as compared to an animal's sensory awareness?
4. Take students outside for a walk. Instruct them to walk slowly, single file, without talking. Tell them to try to concentrate on one sense at a time.
5. The class could be divided into groups with each group assigned one sense on which to concentrate.
6. Have students report on their experience and discuss how individual perspectives differ.

BRANCHING OUT:

1. Have students prepare instructions to teach people to "look" as they walk.
2. Under supervision, have students walk a "blind-fold" trail through a park or nature area. (Stretch a rope from tree to tree and have blindfolded students slowly follow the rope.) After a walk, have students describe what they felt, heard, or smelled. What could they identify?

Lesson 12

HOW MANY TREES ON THAT TRAY?

TIME: 1 hour

OBJECTIVE: To introduce the concept of total resource cost in food production.

MATERIALS: Resource information about food production; information could be from texts, encyclopedias, or brochures from a Cooperative Extension service office. Fast food wrappers and play money.

BACKGROUND:

When people consider the cost of food production, they think in terms of the monetary cost of raising, processing, and marketing animals and vegetables. Rarely is the cost to the natural environment considered. From the beginning of the food production process, though, the environment does contribute to the overall cost through the loss of forested land.

By using land for food production, trees that contribute to the quality of air, water, soil and wildlife habitat are lost. Water and soil quality is further threatened if chemical fertilizers, herbicides, or pesticides from agricultural land are washed into water sources or leached into soil.

Humans need both food and the many benefits of a healthy natural environment; producing food in a manner that protects and preserves the environment is possible (using organic fertilizers and pesticides) and doing so begins with an awareness of the total cost of food.

BEFORE THE ACTIVITY:

Review resource material including facts such as labor costs to produce food, transportation costs, and per capita expenditure for food in North Carolina.

Display fast food wrappers.

LEAD-IN:

What did you have to eat today? Now, where did it come from? Not the grocery store or a restaurant, but where did it really come from?

Let's list the food we ate today and try to figure out where it all came from. Then let's try to get an idea about the cost of each item.

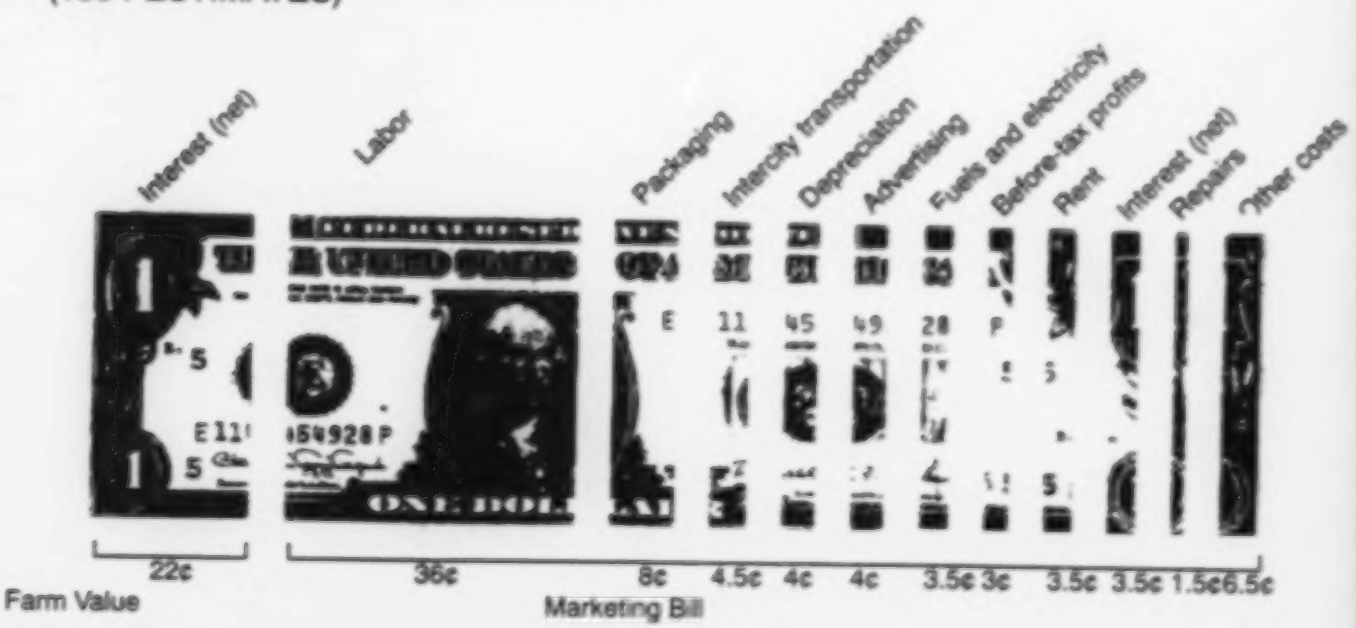
ACTIVITY:

1. Have the class make two lists. The first list should be all the food eaten that day. The second list should be an idea about the origin of the food such as:
   Beef—a Western state
   Milk—a nearby dairy
   Bread—a bakery in town
   Vegetable—grown at home or on a produce farm
   Cereal—grain from the Mid-West
   paper/packaging—pulpwood trees from North Carolina.
2. Assign each student or small group a food to research. Where is the origin of each food and what must be done before the food reaches the table?
3. Have students or groups report back to the class.
4. Using the acquired information, try to compute the actual cost of the food. Look at:
   Amount of land needed for production
   Labor costs
   Fuel costs
   Cost of packaging including cost to forests
   Cost of running the grocery store
   Cost of selling in a restaurant
   Any costs to the environment as a result of land use such as fertilizer runoff or soil erosion.

BRANCHING OUT:

1. Discuss ways to maintain food production while protecting the environment.
2. List at least three ways to produce food that are better than existing methods.
3. In North Carolina today we have more acres of forest than we did in 1900. Improvements in agriculture made this possible. If agriculture production increases, what predictions for our forests can be made?
4. Food for Thought: Where does your food dollar go? Farmer, worker, transport, profit? Have students compare their estimates with those from the Farm Bureau below.

COMPONENTS OF A FOOD DOLLAR
(1994 ESTIMATES)



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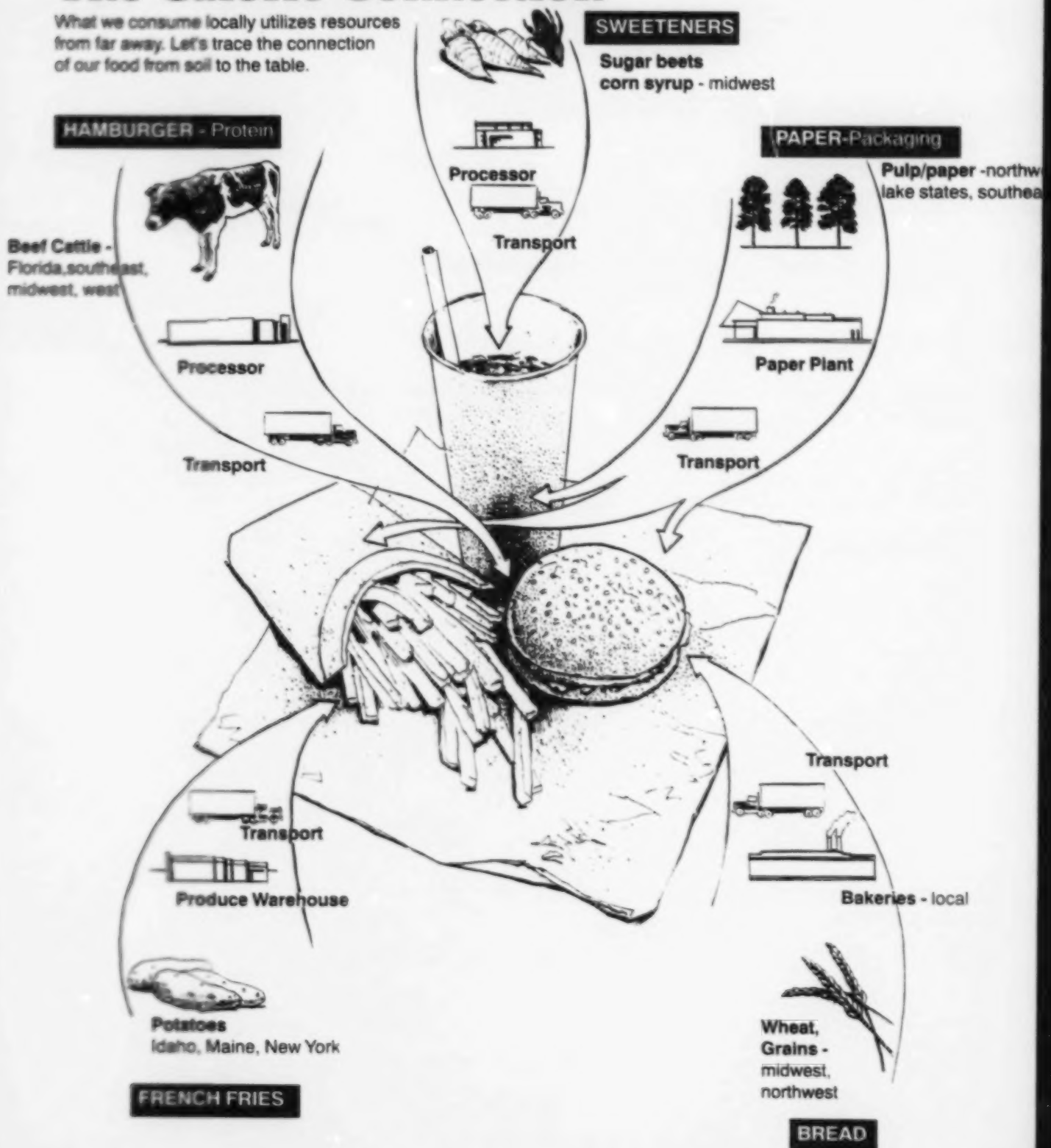
The Calorie Connection

What we consume locally utilizes resources from far away. Let's trace the connection of our food from soil to the table.



Lesson 13

CAMP OUT!

TIME: 2 one-hour sessions

OBJECTIVE: To understand the concept of recreational land use.

MATERIALS: Gather resource information about campground development, the regulations concerning the development, and health regulations affecting campgrounds. Also, provide resource material about wildlife in the area. The local library, extension office, and nature center could help with this.
Newsprint and colorful markers
Handout (page 45)

BACKGROUND:

America's love of the outdoors and outdoor recreation began early in the nation's history. It led to the 1872 establishment of the world's first national park at Yellowstone, Wyoming; and continues today with an increasing demand for more land made available for recreational use.

This interest in the outdoors is spurred both by a desire for better health and a desire to observe and become involved with wildlife. Sometimes the activities inspired by these interests overlap. The national trend toward better health through exercise has people walking, hiking, canoeing, rafting, skiing, and camping. Contemporary urban life styles and the recent recognition that many wildlife species are decreasing in number or becoming endangered has made observing wildlife an attractive pastime. Wildlife observers such as birders are often also hikers or campers.

These outdoor recreationists present an interesting and potentially profitable challenge to private landowners who elect to open their land for hunting, fishing, and camping among other activities. Careful planning on the part of landowners is necessary to provide recreationists with desired amenities while preserving the environment that attracts visitors.

BEFORE THE ACTIVITY:

Review and become familiar with resource information. Think of all the ramifications involved with campground development. This could include the following design considerations for campsites.

1. Sites should have an access road.
2. Minimum site living space is usually 25' x 25'.
3. Sites should be a size and shape convenient for all types of camping equipment.
4. Campsites should be level and lined with a material such as fine gravel which inhibits erosion.
5. Water movement should be considered to prevent erosion.
6. Site perimeters should be marked possibly with railroad ties.
7. A screen of vegetative growth between sites allows privacy and reduces noise.
8. Consider tree location and shading when sites are designed.
9. Hardwood trees are preferable since they resist disease better than conifers.

LEAD-IN:

Has anyone been camping or hiking recently?

Has anyone been on a river or been fishing at a lake?

What did you take with you on your outdoor trip, and what did you leave behind?

Suppose you own twenty-five acres of land. (An acre is 43,560 sq ft; many shopping centers including parking lots are five to ten acres in size.) Some of these acres are wooded, some are meadows, and some have streams that feed into a nearby river. Your land has lots of birds and some wildlife.

Then suppose that your land is the only land around that is large enough and pretty enough to attract campers. You want people to be able to camp, fish, hike, and cook over a camp fire. So, you decide to open a campground.

How would you design your campground?

ACTIVITY:

1. Remind the students of these specifics about the land that they own:
   a. They have twenty-five acres: eight acres are woods; four acres are brush and shrubs; other acres are open.
   b. The acreage has three streams and one wetland area that has standing water after a rain.
   c. The land faces southwest.
   d. The river flows east.
   e. The lake is part of a nearby adjoining property and there is no road to the lake.
   f. One two-lane road accesses the property from a major highway.
   g. A dairy farm is three miles away and west of the land which could create an odor problem on some days.
2. Have class members brainstorm and list what they think would make an ideal campground. Put the list aside temporarily.
3. Divide the class into small groups and have them decide which topics each group will research.

Topic could include:

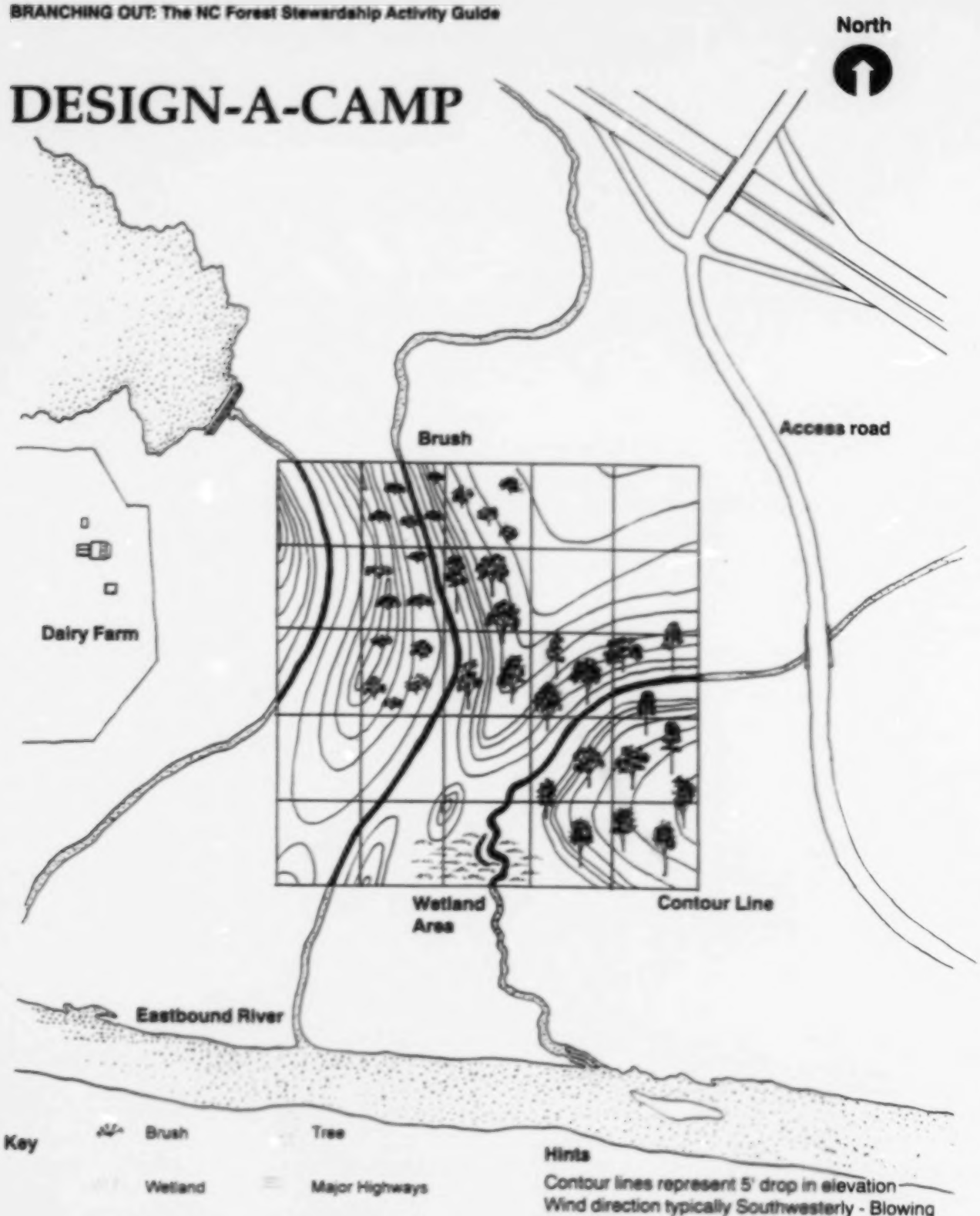
wetlands
fishing regulations
wildlife regulations
contour of the land
direction of wind
layout of land

4. Reconvene the class and use the researched information to design a campground.
5. Compare these plans with the list compiled at the beginning of the activity.
6. Allow students to make mistakes and then point to problem areas at the end of the activity so that students may learn the many complications that could be involved. A potential problem that could be overlooked by the students would be the results of the wind blowing from the dairy farm to the campground.

BRANCHING OUT:

1. Explore the planning, management, and use of trails, camp grounds, and parks in your area.
2. Invite a campground or park manager to speak to the class. Prepare questions for the speaker in advance.
3. Find out if any local parks are made over landfill areas. Invite the park manager to speak about the special problems and concerns of such parks.
4. Adopt a campground or park to monitor or cleanup.
5. Plan and implement a camp-out.

DESIGN-A-CAMP



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I LOOK LIKE A FOREST STEWARD

Lesson 14

TIME: Varies

OBJECTIVE: To implement forest stewardship.

MATERIALS: Newsprint and markers
Descriptions of local areas such as parks or greenways

BACKGROUND:

The old adage "bloom where you are planted" holds true for stewardship. Anyone can be a forest steward and make a beneficial change to the land; training as a park ranger, forester, or wildlife biologist is not required.

Information on the Forest Stewardship Program is available through the North Carolina Cooperative Extension Service, North Carolina Wildlife Resources Commission, North Carolina Division of Forest Resources, and the USDA Soil Conservation Service. These offices can provide the help necessary to begin stewardship practices.

BEFORE THE ACTIVITY:

Check the resource pages that are appended to the lessons section; they contain suggestions for class projects. Then consider what actions could be taken to improve the local area. Planting flowers, shrubs or trees is a possibility but could require permission. Consider planting specific flowers to attract birds or insects; red flowers attract humming birds and butterflies. Another possibility is building a bird or bat house (instructions on page 19), or build a bird feeder that provides food and shelter for birds as well as squirrels.

LEAD-IN:

Have you ever wished you could change something about your school or neighborhood environment?

Let's look around our natural world and see what's going on. And then, let's see what we can do to make it better.

ACTIVITY:

1. Have students look around the school or neighborhood and list at least fifteen changes that could be made to create a better environment.*
2. If the students have difficulty with this activity suggest adding flowers to an area. Other suggestions could be to mulch a path (construct a path and line it with mulched material), make a water bar (log or rocks placed to direct the flow of water off a path) or to show succession (the types of growth that follow one another) by not mowing a section of the school grounds.
3. Choose which activities could be accomplished and become a steward.

*North Carolina Wild School Sites Program could be a resource for planting on school grounds.

BRANCHING OUT:

1. Students can develop changes for the neighborhood and plan how they would present their recommendations to the city council or parks and recreation director.
2. Invite an architectural firm representative to explain how decisions are made about what to keep and what to remove from a natural setting when buildings are planned.
3. Ask an extension agent to explain trail design and maintenance.
4. Have a parks and recreation representative discuss grounds maintenance.
5. Maintain a nature trail or section of a park /greenway.
6. Practice simulated town council presentation.

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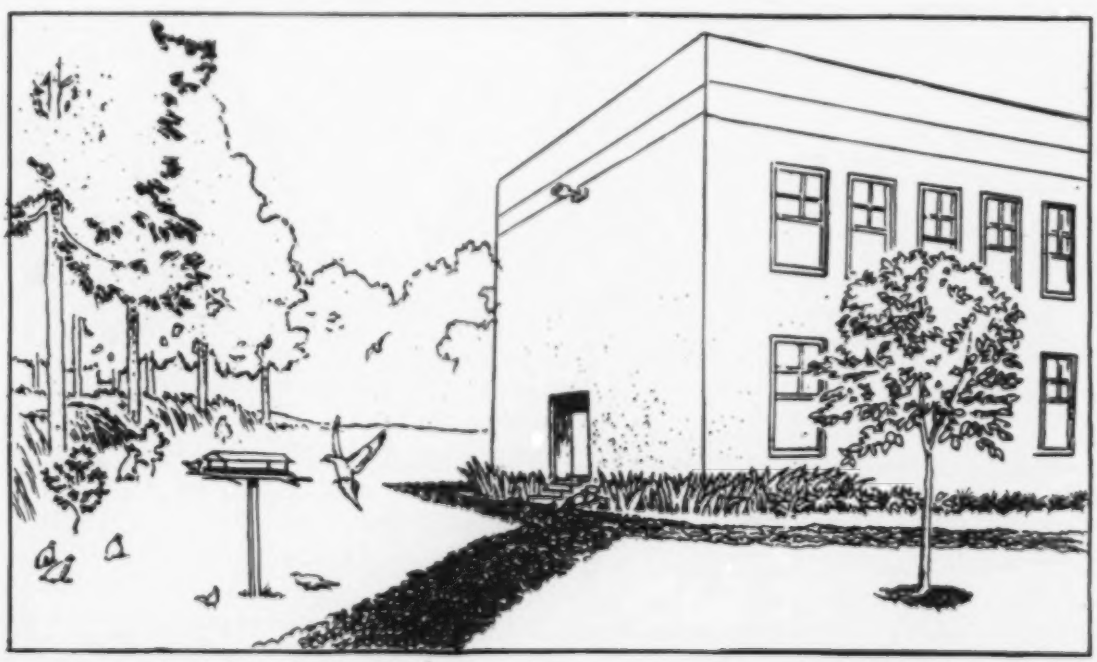
Stewards At School

You can make a difference in your own environment. Birds, bees, butterflies and small animals can benefit from small improvements that you make to your school grounds. Make a difference. Plan, prepare and get permission to steward your school grounds. Can you name other improvements that can be made?

Before



After

RESOURCE LIST FOR ADDITIONAL ACTIVITIES

Activities are found in *Aquatic Wild* (AW), *Project Learning Tree* (PLT), and *Project Wild* (PW).

Lesson 1 FSP AND ME

"Forest for the Trees" (PLT)
Students will participate in a simulation designed to teach how forest resources are managed and simulate managing a piece of land for various products.

Lesson 2 WHAT IS A FOREST?

"Then and Now" (PLT)
Students will describe the environmental changes that have occurred in their community over the course of time, discuss whether those changes have been positive or negative for the community, and discuss ways to remedy negative changes.

"My Kingdom for a Shelter" (PW)
Students create replicas of wildlife shelters.

"Planning for People and Wildlife" (PW)
Students imagine and research what the area in which they live was like before a community was developed; design planned communities, and build and evaluate models of their community design.

Lesson 3 HOW CONVINCING ARE THE FACTS?

"Forest Consequences" (PLT)
Students will evaluate the options for managing or using a piece of forested land and make land-use decisions and explore the consequences of that decision.

"Three Cheers for Trees" (PLT)
Students will describe the ways in which trees benefit people and make pictures or models depicting how trees may be used to improve the human-made environment.

Lesson 4 WHAT'S THE USE?

"Make Your Own Paper" (PLT)
Students will make recycled paper from scrap paper, describe the steps of the papermaking process and identify the elements and outputs of the process, and compare making paper by hand to the process used in factories.

Lesson 5 SHARING SPACE WITH WHAT?

"And the Wolf Wore Shoes" (PW)
Students divide books into those about "real" and those about "make-believe" animals, and then distinguish between real and fictitious animal characteristics.

"Does Wildlife Sell Cigarettes?" (PW)
Students evaluate and categorize advertisements.

Lesson 6 POINT TO THE PROBLEM

"The Glass Menagerie" (AW)
Students observe and describe changes in physical characteristics of several different experimental aquatic habitats that they create.

"Water Wonders" (PLT)
Students will simulate the paths that water takes in the water cycle, describe the importance of the water cycle to living things, conduct an experiment to discover how plants affect the movement of water in a watershed, and describe how plants are important in maintaining water quality.

"No Water Off a Duck's Back" (PW)
Students conduct experiments using water, oil, hard-boiled eggs, detergent, and feathers.

Lesson 7 HABITAT: HEALTHY OR HURTING?

"Dynamic Duos" (PLT)
Students will examine close relationships that exist between different organism and explain how partners in these relationships help each other to survive.

"How Many Bears Can Live in This Forest?" (PW)
Students become "bears" to look for one or more components of habitat during this physically-involving activity.

Lesson 8 WETLANDS MAKE A DIFFERENCE

"Dragonfly Pond" (AW)
Students create a collage of human land-use activities around an image of a pond.

"Watch on Wetlands" (PLT)
Students will study a wetland ecosystem and analyze the issues and opinions relating to the management and protection of wetlands.

Lesson 9 FIELD REPORT

"Field, Forest and Stream" (PLT)
Students will investigate and measure components in three different ecosystems, describe similarities and differences they observe among three ecosystems, and identify ways that the

abiotic components of an ecosystem affect the biotic components.

"Forest in a Jar" (PW)
Students conduct an experiment using soil, water, seeds, a plant, and a jar; and then draw a poster to represent their observations and findings.

"Wild Words...A Journal-Making Activity" (PW)
Students go into an outdoor setting to make and write in journals they design.

Lesson 10 THE TRAVELING WATER SHOW
"The Edge of Home" (AW)
Students explore the concept of ecotones by visiting places where habitats overlap.

"Where Does the Water Go After School" (AW)
Students measure and calculate the area of the school ground; calculate the volume and weight of water falling on the school ground; determine specific and annual rainfall and runoff; and trace the course of that water to aquatic habitats.

"Water Wonders" (PLT)
Students will simulate the paths that water takes in the water cycle, describe the importance of the water cycle to living things, conduct an experiment to discover how plants affect the movement of water in a water shed, and describe how plants are important in maintaining water quality.

Lesson 11 WHO'S THERE?
"The Peppermint Beetle" (PLT)
Students will describe various ways animals use their sense of smell, explain why some animals use scent marking, and identify the importance of the sense of smell in our daily lives.

"Adaptation Artistry" (PW)
Students design and create imaginary birds, and write reports including descriptions of the birds' adaptations.

Lesson 12 HOW MANY TREES ON THAT TRAY?
"Lobster in Your Lunch Box" (PW)
Students plan and calculate the costs of a family's meals for one day; create a classroom chart; and analyze, discuss, and summarize findings.

"What Did Your Lunch Cost Wildlife?" (PW)
Students trace food sources, diagram environmental impacts, and apply the knowledge they gain by making changes in some of their consumer choices.

Lesson 13 CAMP OUT
"Loving It Too Much" (PLT)
Students will explain how increased numbers of park visitors and activities outside park boundaries affect ecosystems within national and local parks and offer possible solutions to problems facing national and local parks.

"Playing Lightly on the Earth"(PW)
Students look for evidence of games that harm the environment; and then invent and play games with a benign effect on the environment.

"To Zone or Not to Zone" (PW)
Students role-play a meeting of a county commission pertaining to a land-use issue.

Lesson 14 I LOOK LIKE A FOREST STEWARD
"Can Do!"(PW)
Students select a school environmental project; conduct research; make plans; and follow procedures to accomplish the project.

"Improving Wildlife Habitat in the Community"(PW)
Students design and accomplish a project to improve wildlife habitat in their community.

GLOSSARY

abiotic: Nonliving components of an ecosystem

algae: any of numerous chlorophyll-containing plants of the phylum Thallophyte, ranging from unicellular to multicellular forms in fresh or salt water

anaerobic: living in the absence of air or free oxygen

aquifer: any geological formation containing water

biological diversity: The variety of life forms in a given area. Diversity can be categorized in the number of species, the variety in the areas of plant and animal communities, the genetic variability of the animals, or a combination of these elements.

biotic: The living components of an ecosystem— flora and fauna

conifer: a plant that bears its seed in cones

decomposer: a plant or animal that feeds on dead material and causes its mechanical or chemical breakdown

ecosystem: all living things and their environment in an area of any size; all are linked together by energy and nutrient flow

evergreen: a plant that does not lose all its leaves at one time

filter: any substance (paper, charcoal sand, cloth or fiber) through which air, smoke, or liquid passes to remove suspended impurities or recover solids

Forest Stewardship Program: a technical assistance program to help private landowners manage all their forest resources—soil, water, wildlife, timber, recreation, beauty, and endangered species—for today and for future generations

greenway: a linear park or connected system of recreational trails linking parks to residential and urban areas

habitat: the native environment of an animal or plant, or the kind of place that is natural for an animal or plant

hardwood: a deciduous or broadleaf tree; the wood from such trees

harvest: removal of forest crops for eventual use in the marketplace

hydric: a descriptive term referring to plants and soils existing in flooded, saturated and ponded areas

lumber: timber sawed or split into planks

nonpoint source pollution: pollution that might be runoff from fertilizer, soil from road building or construction, or pesticides from a lawn

nutrient: a chemical compound required for life of an organism

organism: a form of life composed of mutually dependent parts that maintain various vital processes

ozone: a form of oxygen, having three atoms to a molecule

point source pollution: pollution that comes from a specific place such as a drain or pipes

pollution: harmful substances deposited in the air, water, or land leading to a state of dirtiness, impurity, or unhealthiness

recycle: the salvage and reprocessing of used materials (such as paper, metals, glass, cloth or fiber)

transpiration: vapor water loss by land plants

Additional Activity Guides/ Environmental Education Programs

Aquatic Wild, N. C. Wildlife Resources Commission, Division of Conservation Education, 512 N. Salisbury St., Raleigh, N. C. 27611, (919) 733-7123. Aquatic Wild is a conservation education for educators of kindergarten through high school youth. Activities center around the needs of aquatic animals and their interrelations with man and the environment.

Cast- off Capers, 4-H Solid Waste Curriculum, Contact: local county 4-H Agent or 4-H Specialist, Box 7606, NCSU Campus, Raleigh, NC 27695-7606. An integrated resource curriculum tackling the issue of solid waste management from reuse and recycling to energy conversion and landfilling.

Discovering The Forest, Instructor's Activity Packet, N.C. Division of Forest Resources, Dept. Env. Health and Natural Resources, Archdale Bldg, Box 27687, Raleigh, NC, 27611, (919) 733-2162. A series of 40 forestry, wildlife, soil and water activities for elementary and middle school students. The packet is designed to stimulate environmental sensitivity through an appreciation and understanding of the forest environment. Each school was sent a copy of this packet in the past.

Project Learning Tree, State Coordinator, Extension Forest Resources, NCSU, Box 8003, Raleigh, NC 27695-8003, (919) 515-5518. PLT is an environmental education project jointly sponsored in North Carolina by the N.C. Cooperative Extension Service and the N.C. Forestry Association. Free activity guides for grades K -12, newsletter and other materials following attendance of a training session.

Project Wet (Water Education for Teachers), N.C. Environmental Health and Natural Resources, Division of Water Resources, P.O. Box 27687, Raleigh. N.C., 27611, (919)715-5433. Project Wet is a broad-based water resource curriculum for students K-12. Project wet focuses on the value, cultural, historical, and legal issues for the water resource.

Project Wild, N.C. Wildlife Resources Commission, Div. of Conservation Education, 512 N. Salisbury St., Raleigh, N.C., 27611, (919) 733-7123. Project Wild is a conservation education project for educators of kindergarten through high school youth. Activities center around the needs of wildlife and their interrelations with man and the environment.

Ripples: A Big Sweep Activity Guide, UNC Sea Grant Program Pub. UNC-SG-90-02. Ripples is a collection of 16 activities concerning litter in the aquatic and marine environment. Activities are designed for the elementary 9- to 11-year-old student.

River's Edge, 4-H Environmental Science Adventure, Contact: local county 4-H Agent or 4-H Specialist, Box 7606, NCSU Campus, Raleigh, NC 27695-7606. An integrated resource curriculum with Leader's Guide, student book and activity sheets to support 25 action-oriented environmental discovery projects.

Stream Watching With Kids - An Outing Leader's Guide. Contact Stream Watch Coordinator, N.C. Division of Water Resources, 512 N. Salisbury St., Raleigh, NC 27611. (919)-733-4064. General information on Stream Watch Program. *A Guide to Stream Walking,* a loan copy of videocassette tape of Stream Watch play.

Water Words: A Word Game. Division of Soil and Water Conservation, Department of Environment, Health and Natural Resources. Archdale Bldg., Raleigh, NC 27611.

North Carolina WILD Notebook, Free subscriptions are available to teachers/educators by writing the Division of Conservation Education, N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, NC 27604-1108.

North Carolina Wild Notebook is produced eight times each year by the Division of Conservation Education of the N.C. Wildlife Resources Commission. It is designed to help educate young people about the environment and the need to conserve our natural resources.